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ABSTRACT

The nature of the cognitive style of field articulation and its relationship to differentiation of personality are discussed. A short historical summary of research on field dependence-independence is presented, and problems of measurement, stability, and evolution of the dimension of field articulation are discussed. The connections between field articulation and various physiological manifestations as well as other cognitive and noncognitive aspects of personality are examined, and the hypotheses relative to the origin of individual differences are considered. The most frequently used indicators of field articulation are the Rod and Frame Test and the Embedded Figures Test. Field articulation and the cognitive functions of perception, learning and memory, and problem solving are covered. A discussion of the origin of individual differences within the area of field independence/dependence considers heredity and socialization in interindividual differences, sexual differences, and cross-cultural studies. It is concluded that under Witkin's influence, numerous correspondences between individual differences in the perceptual domain and in contiguous personality sectors (e.g., cognitive function, social behavior, defense mechanisms) have been established. A bibliography is included. (SW)

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# COGNITIVE STYLE: FIELD DEPENDENCE-INDEPENDENCE[1,2]

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The use of the expression "cognitive style" is relatively recent in psychology. According to Vernon (1973) it was first used in Klein's (1951) "The Personal World through Perception," a chapter in Blake and Ramsey's work, Perception: an approach to personality. For Klein, the perceptual mode is "an organizational style," which is characteristic not only of perceptual phenomena but also, and on a larger scale, of the type of relationship maintained by the individual with his surroundings. Witkin (1965a, p. 217) gives a similar definition of the notion of cognitive style: "Recent research has shown that people have a characteristic and coherent mode of functioning in their intellectual and perceptual activities. These cognitive styles, as they have been called, are manifestations in the cognitive sphere of still broader dimensions of individual functioning; dimensions that are found elsewhere in psychology."

Field articulation is a dimension which has been studied by Witkin in particular, and which allows individuals to be distinguished according to their ability to perceive an element as separate from its context and to adopt an analytical approach to problem solving.

We will specify the nature and the levels of this dimension and we will see how it represents, in the field of cognition, a still broader dimension of personality--degree of differentiation. Differentiation

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refers to those formal aspects of the personality which can be more or less structured, more or less isolated from the environment, and that more or less fill specific functions. It should be noted that other cognitive styles have been suggested on the bases of perception, memory, concept formation, and decision making.

If the expression cognitive style is recent, this mode of approach to the study of personality is much less so. Studies of cognitive styles can be compared to the typological studies of the German school. Vernon, for example (1973), sees in the notion of cognitive styles, a resurrection of the older notion of type, which is itself subject to debate. In the German typologies, attempts at classification are numerous. As early as 1924, Munz showed that pyknic types could be distinguished from leptosomic ones by their responses to the Rorschach test, E. R. Jaensch's typology is primarily based on cognitive processes, i.e., the disposition to furnish eidetic images. It was a student of Jaensch's, Schmidt, who, in 1938, used individual differences in the judgment of verticality as a test of personality. We will see how perception of the vertical, under varying conditions, is at the origin of Witkin's work. However, there is no direct connection between these typological studies and the work done on cognitive style. In the area of individual differences where the connection is direct (the Allport-Vernon-Lindzey values derive from Spranger's typology and Eysenck's introversion-extroversion dimension is based on that postulated by Jung), there has been an interest in the global aspects of personality, the approach not being however through the medium of cognitive processes.

The problem of cognitive styles has been equally clearly defined in an entirely different framework by students of individual differences such as Binet, and more recently, Thurstone. In L'Etude experimentale de l'intelligence (1903), whose "principle aim was to study what is individual to each of us in ideation" (p. 185), Binet, in about twenty experiments, demonstrated how each of his two subjects was characterized by a group of coherent traits. These traits concerned, naturally, the cognitive domain, but they were also part of the "personality". If this aspect of Binet's work is generally unknown, the importance of Thurstone's is underestimated. Thurstone quite clearly defined the guiding principles behind work on cognitive styles in the introduction to his 1944 work, A Factorial Study of Perception. According to this, it is possible, by using the study of cognitive functions as a starting point, to draw inferences about personality, and the study of these functions, considered at elementary levels, should allow us to define parameters which determine behavioral style and intellectual activities (p. 1). In the course of a vast exploratory study, which was to be followed by more systematic work, Thurstone identified a factor closely related to field articulation--flexibility of closure--which he felt could be more widely generalized. Although Thurstone's work led to further observation, notably on the part of Pemberton and Guilford, work on field articulation was, nevertheless, developed outside the traditional domain of the psychological study of in dividual differences. It would appear that Binet and Thurstone were victims of their psychometric success.

Beginning around 1950, studies on cognitive style, particularly among those experimental psychologists interested in perceptual mechanisms, proliferated. Within the perspective of the "new look", systematic studies of the role of attention and motivation in perception were undertaken--work which led to a study of the role of personality. This development had been suggested by Fraisse as early as 1949, and by Klein (1954) who had been developing the concepts of ego psychology. For Klein there are cognitive mediational and regulatory structures inserted between perception and needs. These cognitive controls would then constitute the cognitive style of the individual. Witkin's work, whose course will be traced later, originated within a different general theoretical framework--that of gestalt psychology.

Even using selective criteria, Witkin and his associates, in a survey of the literature from 1954 to 1972 (1973a), found 1,700 references to field articulation, the publication of which constituted an almost geometric progression. There were twice as many studies published in 1971 as in 1966 and four times as many as in 1962. Thus, in this review we do not claim to be exhaustive, but rather, by examining the literature since 1962, the publication date of Witkin et al.'s Psychological Differentiation, to trace the important lines of research. We will not deal with the relationship between field articulation and other cognitive styles.

After a short historical summary, we will treat, in order, the problems of measurement, stability, and evolution of the dimension. Then we will examine the connections between field articulation and various physiological manifestations as well as other cognitive and non-cognitive aspects of personality. We will conclude by examining the hypotheses relative to the origin of individual differences.

## I. The Genesis of Witkin's Work Before 1962: From Experimental Perceptual Psychology to the Psychological Study of Individual Differences.

Witkin, in the forties, was interested in the perception of verticality. This was an old problem (Aubert's effect having been demonstrated in 1860), but one in which interest had been rekindled by developments in aviation. Following up the work of Wertheimer, Witkin proposed to conduct research into the respective contributions of visual and kinesthetic cues in the perception of verticality and to treat it as a problem of psychology in general.

The experimental devices used aimed to disassociate the two types of cues which in everyday experience normally occur together. At present two of these devices remain in common use: the Tilting-Room-Tilting-Chair Test (TRTCT) and the more well known Rod and Frame Test (RFT). In the TRTCT, the subject is seated in a tilted chair within a room which itself is inclined. His task is to return his body to true vertical. The subject who uses visual cues only will align his body parallel to the "vertical" of the room whereas the subject who utilizes only postural cues will align his body according to true vertical. The difference

between these verticals will be a measure of the respective influence of these two kinds of cues. The subject can also be asked to orient the room to vertical, his body remaining tilted. As in all test of this type, a series of trials is used so as to vary the direction of tilt of the subject or the field (here in the room). In the original RFT, the subject himself was tilted in most of the trials and was required to adjust a luminous rod to true vertical. Darkness suppressed the visual reference marks and the rod was placed inside a luminous tilted frame. If the subject used postural cues only, his adjustment would be exact. On the other hand, the use of visual cues, as in the preceding situation, would lead to error. In yet a third situation, seldom used after 1954 -- the Rotating Room Test--the subject and the room remained upright but revolved around a vertical axis in a horizontal plane. The subject was to adjust his body or the room to vertical. Here, because of the existence of centrifugal force, the largest errors were made by subjects who preferred to depend upon postural cues.

The results of the measurement of adjustment errors show that both types of cues are used and that on the average visual cues are the stronger. But the most striking and unexpected phenomenon was the amplitude of individual differences (Witkin, 1959). These are such that, according to Witkin, it is not possible to account for the relative importance of visual and posture cues in a way valid for all participants within an experimental group. The subjects are situated, as far as spatial orientation is concerned, on a continuous "postural-visual" dimension whose poles can be defined thusly: The vertical determined by information derived from the body (or independent of the visual field) and the vertical determined by information derived from the visual field. It has been noted that these individual differences are stable and that girls are more field-dependent than are boys which suggests that differences in spatial orientation can be related to differences in personality.

Subsequent research was then oriented toward a study of individual personality differences and a synthesis of this research--Personality through Perception--Witkin et al.) was published in 1954.

Individual differences in the adjustment of the vertical are associated with many other differences on perceptual tests, and notably, with differences in the ability to analyze embedded figures (Embedded Figures Test: EFT), similar to those proposed by Gottschaldt (1926). With the EFT, it should be kept in mind that the subject's primary task is to discover a simple element within a complex design. From this point on, the EFT was utilized in conjunction with the RFT and the TRTCT in an effort to define a broader dimension than that of spatial orientation--namely, dependence or independence in relationship to the field. Field independence is the ability to isolate an element within a field. The element can be the subject's body in the TRTCT, the rod in the RFT, or a geometric design in the EFT. This dimension is similar to those proposed elsewhere. We have already cited Thurstone's structural flexibility, and Gottschaldt's figures as modified by Thurstone, were strongly influenced by this factor, but not, however, to the point of being considered an indicator of it. Let us add to this Meili's plasticity factor (1946), the

spatial decontextualization factor (Poddel & Phillips, 1959) and the adaptive flexibility factor developed by Guiford.

In the work published by Witkin et al. in 1954, correlations were sought between tests of perception and scales constructed on the basis of interviews and projective tests whose aim was to evaluate the relationship with the environment (passivity-activity), the strength and control of drives, and self-evaluation. Subsequently, and especially in Psychological Differentiation (Witkin et al., 1962), an extension of already explored terrain simultaneous with a new enlargement of the dimension is to be noted. Thus, the theoretical framework which will continue to inspire the greatest part of the research is presented as a general conception of differentiation along with a hierarchical integration inspired by the work of Lewin and Werner. A highly differentiated psychological system possesses numerous and specialized sub-systems. It is characterized by its degree of differentiation and complexity as well as by the number of possible means of integration. Efficiency in terms of adaptation is not however a function of the degree of differentiation, but rather the general level of differentiation permits the realization of coherency between the various behaviors. This model proposes then to explain individual differences even though it was originally conceived in order to clarify developmental differences, and thus it is valid to ask if, in fact, it does not reduce the former to the latter, or in other words, if it does not facilitate a unidimensional concept of development--a concept which was, moreover, not that of Werner. The formal and dynamic character of the notion of differentiation renders it highly heuristic, and, starting from this point, Witkin's group derived several concepts which have demonstratable productivity; the degree of articulation of body schema, sense of individual identity (a matter of consciousness of one's own needs, feelings and attributes and of their identification as distinct from the needs, feelings and attributes of others) and the structure and specialization of defense mechanisms. The constant expansion of the initial dimension has been described, notably by Witkin (1959) and by Faterson (1962).

The dimension under consideration can be viewed at several hierarchical levels of varying generality according to the extensiveness of the sector being studied. The names of these levels are presented in Table I (after Witkin et al., 1962; Witkin, 1965).

## II. The Most Frequently Used Indicators of Field Articulation and Their Relationships with One Another.

### The Rod and Frame Test.

The RFT and the EFT are the most frequently used indicators of field articulation. For the most part researchers have substituted less expensive, portable instruments for the RFT. Such instruments, which do not necessitate darkness, can also be easily used with the mentally ill and with young children. These tests have been validated by means of Witkin's original testing instrument, and the coefficients of validity are generally

satisfactory: .89 (Oltman, 1968); .74 (Morris, 1967); .77 (Kato, 1965b); and .46 (Vaught, 1969, and for the same apparatus after improvement, .87 and .70 (Irving and Anderson, 1971). Oltman's RFT which does not require the body to be tilted is the most often used.

The use of the RFT poses various methodological problems which can affect the validity of the measure. Two reviews have dealt with these problems (Lester, 1968; Berman & Bergman, 1973). However, beyond the question of standardization, there has been an attempt to define more precisely the role of the starting position of the rod, that of the tilt of the body and that of the instructions given the subject. The effect of the initial position is relatively unimportant compared to that of the tilt of the body (Bermman & Bergman, 1973), and a consequence of the latter is a relatively large displacement of the subjective vertical in the direction of the body for acute inclinations (the Aubert effect), but in the opposite direction for moderate inclinations (E-Muller effect). It is now considered preferable to eliminate this source of variation. Task performance as influenced by instructions could also cause variation but, instructions which oriented the subject's attention toward the frame as well as instructions orienting attention toward the body seemed to have no effect (Colson et al., 1965). Further sources of error include the difference between true vertical and subjective vertical in the absence of body inclination, lighting level, speed of rotation of the body (B.M. Long, 1973), duration of exposure (Hayes & Venables, 1974) and definition of true vertical (Lester, 1968).

Usually the direction of the error is not taken into account, the score being the sum of the absolute values of the difference from vertical on each item. There exist, however, stable individual differences in the direction of the error for position of the body in relation to that of the frame. These have been interpreted as sets to respond and thus as unrelated to field dependence (Cabe, 1968; Hellkamp, 1968) or as being directly related to field dependence. Benfari and Vitale (1965) used the direction of the error to distinguish between subjects oriented toward the body or toward the frame, but a relationship between the direction of the error and field dependence, that is, the magnitude of the error, has not been observed (Barret & Thornton, 1967). More recently, Dershowitz (1973) has interpreted the direction of error (in the TRTCT) in terms of inhibition and rigidity.

The Embedded Figures Test.

Witkin's embedded figures are those of Gottschaldt but with color added so as to enhance their structure (Witkin, 1950). Testing is individual, and the score is the time necessary for the discovery of the simple elements in the designs. The subject can use up to five minutes per item, but the difficulty of this test makes its utility minimal below the age of ten. Thus, using the same principle, tests possessing good metric qualities and usable from the age of five have been established (Goodenough & Eagle, 1963; Karp & Konstadt, 1963; Dreyer et al., 1969), and further tests designed for three-year-olds have also been devised (Banta cited by Witkin, 1967). An abbreviated adult version--twelve items instead of twenty-four

and only three minutes per item--correlates at more than .95 with the original test (Jackson, 1965).

Internal studies conducted within the perspective of a clinical diagnosis of cerebral lesions have elicited three types of items from the properties of the complex design: good form, asymmetry, and three-dimensionality (Gordon & Tikofski, 1961).

Numerous forms of the EFT exist, most of them appropriate for group administration. In France a test of this type has been developed by Château (1959). The correlations can be very weak between these tests and Witkin's EFT--from .35 to .99 in a survey done of 24 correlations (Arbuthonot, 1972), occasionally .25 (Eisner & Williams, 1973)--that is a 6 per cent shared variance. All hidden figures tests cannot be considered to measure field dependence. A summary analysis suffices to show that the different tests do not call into play the same psychological processes and are not affected by identical biases. Compare, for example, the EFT-Witkin and Thurstone's hidden figures test (French, 1963) which are frequently but erroneously considered as interchangeable. In contrast to the EFT-Witkin, Thurstone's test does not involve memory and the representation of the element to be discovered since this latter is always present during the test. On the other hand, it does call upon the decision making process and can give rise to elaborate exploratory strategies since several complex designs and several elements are being presented simultaneously. Administered collectively, it is much more susceptible to differences in anxiety level and motivation of subjects. Jackson et al., (1969) have systematically studied the role of various characteristics of the EFT by calculating some of the correlations between forms which differ in only one feature. These are .85 (g) and .75 (f) between the EFT-Witkin with and without color; .72 between collective and individual administration, and .50 between two tests distinguished only by the simultaneous presence or absence of the element to be discovered. The memorization of this simple element and the impossibility of proceeding from a visual translation are then important features of the test.

The dimension of field independence or dependence being quite broad, it can in principle be defined by the various indicators. Frequently the figure drawing test is used with an analytical grid permitting the calculation of an articulation score (Witkin et al., 1962). Wechsler's cubes are also used, and Gardner, who interprets this dimension in terms of attentional selectivity, defines field articulation in terms of the strength of illusion in Delboeuf's concentric circles (Gardner & Moriarty, 1968).

Relationship between the Basic Indicators.

Witkin and his associates have studied the relationship among the basic indicators of field articulation and have judged it to be satisfactory regardless of the groups in question--normal adults, sick adults, or children and adolescents from 8 to 21 years of age (Witkin et al., 1962; Witkin et al., 1967). Further, Dreyer et al., (1971) have observed that there is a coherency among these measures that is established by the age

of five. However a fair number of authors question this coherency. If we consider one of the numerous tables of correlation obtained by Witkin (Table II) and if we leave aside for the moment the girls' scores, a doubt can be raised as to the strength of the correlations. The reliability of the tests is good but the correlations are rather far apart, and the degree of common variance is never more than forty per cent. On the other hand, the correlations obtained are approximately on the same rather weak level as those observed between the series of items within the same test, the RFT for example (Table III).

For the most part, the correlations observed are distinctly weaker than those presented by Witkin, and often the degree of coherence obtained is clearly unsatisfactory. In much of the work the proportion of variance common to the EFT and the RFT is less than 20 percent (For example: Gardner et al., 1960; Elliot, 1961; Pressey, 1967; Haronian & Sugerman, 1966; Gruenfeld & Arbuthnot, 1969; Adevai et al., 1968b). Arbuthnot (1972) notes that the mean of 21 correlations between the RFT (Witkin or Oltman) and the EFT-Witkin is .54. Using the shortened form of the EFT, the mean of the correlations examined (19) is less than .40. These correlations are all quite dispersed. The correlations obtained with other pairs of indicators are even weaker. It should be noted however that although this result is hardly ever taken into account in discussion, the calculated indices underestimate the relationship between the RFT and the EFT to the degree that they do not allow for its curvilinear nature. Barret et al., (1968b) found a correlation of .30 between the two variables--a correlation that went to .60 after changing the scores on the EFT to an inverse ratio. Likewise the homogeneity of the groups studied is a factor contributing to the low correlations.

Moreover, the correlation patterns between the RFT and the EFT with other variables differ frequently which may be indicative of nothing more than a distant relationship between the indicators. For example, in general, the EFT has a stronger correlation with measures of intelligence and aptitude than the RFT (Elliot, 1961; Goodenough & Karp, 1961; Haronian & Sugerman, 1966; Handel, 1973).

The study of eye movements will probably permit a more precise specification of the perceptual modality active in each test. In the EFT notable differences between field-independent and field-dependent subjects have been separated out. In field-independent subjects, there are more transitions from the simple figure (when one is present) to the complex figure, distance between fixation points is longer (at least when the complex figure is relatively unstructured) and more importantly, the duration of the fixation devoted to the parts of the figure that are rich in information (angles, line intersections. . . ) is longer (Conklin et al., 1968; Boersma et al., 1969). It should be noted that sex differences are not found at this level. For the RFT, on the other hand, the relationship between ocular strategies and performance is far from obvious.

J. Silverman(1970) has presented a general theory of attention, taking into account some of the differences between the EFT and the RFT. As a result of factorial work, attention is defined by three broad and

independent dimensions (Gaines et al., 1973): control of stimulus intensity, scanning, and selectivity. In selectivity there is justification for distinguishing two factors (Messick & Fritzky, 1963): sensitivity to interference and capacity to perceive according to a more or less analytical mode. These two factors are associated in the RFT while only the first is present in the EFT. This distinction should be compared with that proposed by Gardner on the basis of experimental results which differentiate the extent of attention from its uniquely selective character (Gardner & Long, 1962).

The correlations between indicators depends on the sample of subjects used. In Table II, the well-established result that the RFT-EFT correlation is much weaker for girls than for boys is noticeable. In adult African populations, both urban and rural (in Nigeria) or in African child populations (Zambia), the RFT-EFT correlation is almost non-existent (Wober, 1966, 1967; Okonji, 1969; Siann, 1972). The same result has been found among professional dancers (Gruen, 1955).

Wallach (1962) emphasized the interest that the study of groups as defined by mediating variables of this sort can present for the analysis of behavioral determinants in the RFT and the EFT. The lack of importance of visual cues relative to the importance of postural cues in African cultures has been pointed out. With subjects who have received special training in body movement, the importance of postural cues is stressed. Andrieux (1955) has shown, moveover, that postural cues are as accurate for men as for women, but that the latter use them less spontaneously. These studies do not, it seems to us, call into question the existence of the dimension itself, but rather emphasize the difficulty of finding universal measures and indicators of it.

The weakness of the correlation between the EFT and the RFT and the dissimilarity of the patterns of correlation among the variables have led to the questioning of Witkin's interpretation of the dimension. For certain researchers (Zigler, 1963, and Vernon, 1972 for example), it is simply a general aptitude factor which accounts for the moderate relationship between the two variables. For others (Elliot, 1961), individual differences are salient in test results when considered from the viewpoint of affective reactions, i.e., subjects react with disruption and inefficiency in bizarre and poorly structured situations. We will return to the problem of the interpretation of the dimension.

In conclusion, let us underline the importance of the choice of indicators and the necessity of using those defined by Witkin. Since these measures are not in and of themselves pure, it is necessary, when subdimensions are not of interest, to use several so as to neutralize to some degree the sources of variance external to the dimension under consideration. In other words, this procedure would amount to an emphasis upon the distinction between a test and a theoretical construct (Wachtel, 1972). In studying the correlations between field articulation and other variables, it is reasonable to combine the indicators into a global index or to use a factorial analysis (the loading of the variables in the factor defined by the indicators will then be the object of the search) or, again,

as recommended by Thornton and Barnett (1967a), to use the techniques of multiple regression.

III. Stability and Evolution of the Dimension with Age Stability of the Dimension.

a) Stability test-retest. The coefficients of stability test-retest are high and frequently attain .80 or more for the RFT, whether the interval between the test and the retest is several days or several years (Kato, 1965b; Adevat & McGouh, 1968). They are often less encouraging for the EFT which is more sensitive to differential learning effects and thus not very useful in longitudinal studies. The stability of these tests has a tendency to become greater with age. Witkin et al., (1967), in the course of two longitudinal studies, obtained the coefficients reproduced in Table IV.

b) Effect of drugs. The injection of barbiturates and amphetamines has led to contradictory results: no effects of RFT performance according to Franks (1956) but an appreciable augmentation of indicators of dependence on the EFT with barbiturates, and a diminution with amphetamines according to Callaway (1959). Tranquilizers and anti-depressants seem to have no effect of RFT scores (Pollack et al., cited by Witkin et al., 1962). On the other hand, a clear and prolonged effect of LSD-25 or mescaline when associated with group functions has been found in relation to the time necessary for resolution of the EFT, the time being reduced by one-half on the average (Harman et al., 1966). Broverman et al., (1968), in a detailed examination of the psychopharmacological literature, concentrating upon that concerned with animal studies, have verified that stimulating drugs which activate the adrenergic system (epinephrine, caffeine, amphetamines and glutanic acids) or inhibit the cholinergic system (atropine) entail an improvement of performance in perceptual-motor tests, and, conversely, a reduction of performance in tests of perceptual restructuring. Inhibitive drugs which have the opposite effect on the adrenergic and cholinergic systems result, in the other hand, in a diminution of performance in perceptual-motor tests and an improvement in spatial reorganization tasks. For Broverman, the two task categories are very general, however, and the definition of spatial reorganization is often far removed from that understood within the concept of field articulation.

It has been noted elsewhere (Dinnerstein, 1968) that marijuana, whose effects are adrenergic, increases field dependence.

The absorption of alcohol tends to make subjects more field dependent (Kristofferson, 1968) but this effect, especially noticeable on the EFT, can be attributed more to a reduction in ability to concentrate than to a modification of perceptual capacities (Karp et al., 1965b)

c) Sensory deprivation. Sensory deprivation reduces errors on the RFT (Kurie & Mordkoff, 1970). Jacobson (1968) notes a reduction of field dependence among miners after two and one-half hours of work. The constant noise of the mine and the impoverishment of the visual environment compares,

to some extent, to the situation established by experiments in sensory deprivation. Sensory deprivation seems to act by forcing subjects to orient their attention toward somatic activity. It has no effect on the EFT, once more demonstrating the absence of parallels between the two tests (Witkin et al., 1962, Kurie & Mordkoff, 1970). Error reduction is even more marked if sensory deprivation is replaced by somatic concentration exercises, for example, asking subjects to concentrate on their skin and musculature (Klepper, 1969; Kurie & Mordkoff, 1970). The reduction of errors (30 per cent) observed after several rapid rotations of the subject (Wolf, 1965) can also be interpreted in this manner. Such results pose a problem in that they may lead to an interpretation of individual differences in terms of body sensitivity--a hypothesis rejected by Witkin et al., (1962), rather than in terms of a capacity to master an ambiguous context. However, since these results are obtained only with the RFT, they could easily be demonstrating nothing other than the impurity of this measure of field dependency.

d) Learning. The importance of the practice effect is well known for the EFT, often becoming evident during the test itself as indicated by the fact that the frequency of correctness of an item varies according to its position in the series (Boersma, 1968). Performances on the RFT improve gradually with repetition of the test even though this improvement is rather slow and exhibits degrees of variability among individuals (fig. 1). When practice is massed, it stabilizes more rapidly (Olson et al., 1965). Verbal explanations of the task have no effect whereas a simple knowledge of results leads to rapid learning and equally rapid forgetting (Elliot & McMichel, 1963).

The use of Skinnerian reinforcement procedures reduces or increases errors rapidly depending upon whether correct or incorrect responses are being reinforced. These effects are still considerable a month after the testing session (McAllister, 1970, Small, 1973), and the correlation between tests given before learning and retests given afterward are high.

It is obviously important to know if the practice effect involves techniques that are specific to and characteristic of the test itself or if it involves a more general modification of perceptual capacities. If the latter, then the dimension itself would once more be open to question. Witkin et al., (1962) have demonstrated that progress accomplished on the TRTCT does not transfer to the RFT. Moreover, learning not directly centered on the RFT or the EFT but connected with perceptual capacities as is seen in the training for certain professions, does not seem to modify performance on the tests. If architectural students are more field-independent than other students, they do not become so in the course of their studies (Peterson et al., 1973).

Evolution with Age.

Longitudinal studies (c.f. fig. 2) have shown that field dependence diminishes with age, reaching a plateau at about seventeen. An increase in dependence, sometimes observed during adolescence, is due to a sampling bias (Witkin et al., 1967). Faterson and Witkin (1970) have observed the

same type of development using the figure drawing test. This progression apparently begins very early, around 4 to 5 years of age which is the earliest age for which data is available (Goodenough & Eagle, 1963). Nevertheless the developmental changes in field dependence are not smooth and continuous. Vurpillot (1972), working within the perspective of a genetic study of perceptual organization and using the EFT, has emphasized the importance of the period between 5 and 8 years of age. At that point the primary level of organization where perceptual unities are determined strictly by the laws of organization is superceded by a secondary level characterized in part by the possibility of the articulation of several fields of centration. This evolution is not independent of the acquisition of new intellectual means. However, as Kagan and Kogan (1970) have noted, the genetic perspective which accents developmental discontinuities, and that of the study of individual differences are not coordinated. Further, the great majority of studies completed in the field of individual differences have concentrated on older children and adolescents.

Among the aged (assuming no cerebral disfunction), there is an increase in field dependence insofar as it can be assumed that tests designed for young children are also valid for this age group (Schwartz & Karp, 1967; Markus & Nielsen, 1973; Axelrod & Cohen, 1961). This dependence is much less marked among those elderly who have remained active and does not seem to increase after the age of 70 to 80 years (Karp, 1967), but these findings can be easily explained solely by recourse to the factors of selection and by the inadequacy for this age of the indicators used.

## IV. Physiological Correlates

### Sensory Modalities.

The dimension of field articulation is not characterized by the visual modality alone but involves the kinesthetic, labyrinthic, visceral and cutaneous senses also. Strong correlations--.78 between the visual EFT and the tactile EFT (Axelrod & Cohen, 1961) and .63 between the visual EFT and its auditory equivalent which consists of recognizing a simple brief melody within a more complex one (White, 1953)--have been observed.

Variation in the peripheral characteristics of the visual system such as phoria or stereopsis have no effect on RFT or EFT scores (Barrett et al., 1967, 1968a) but anisometropics are frequently field dependent on the RFT (Culver, 1967). However, even if the capacity for visual discrimination seems to have no relationship with field dependence (Kassan et al., 1965), the same is not true for cutaneous sensation. Field-independent subjects are able to distinguish two skin sites subjected to simultaneous touch and to identify letters traced on the back or front of the hand more easily than are field-dependent individuals (A. J. Silverman et al., 1961). They are also more sensitive to pain (Sweeney & Fine, 1965). This corresponds, as does the greater lateralization of field-independent subjects, to a greater general differentiation and a better articulation of body schema (Witkin, 1965b).

Arousal Level and Sensitivity of the Autonomic System.

A moderate increase in vigilance leading to a greater focusing of attention will result in a diminution of field dependence as demonstrated by Callaway (1959) with amphetamine injections, and Oltman (1964) with a strong auditory stimulus. However, since experimental manipulations of this type do not always lead to an increase in arousal that will be reflected by physiological measurements, it is thus not surprising that they have no consistent effect on field dependence (Hayes & Venables, 1970; Morf & Howitt, 1970). This would explain the failure of certain attempts to modify field dependence (Vaught & Bremer, 1969), as well as indicate the necessity of using physiological indices. However, these indices of arousal face several problems of interpretation. There are links between the modification of alpha activity and field dependence as measured by the RFT, but they are not on the same order, depending upon whether the releasing stimulus is visual or auditory. Alpha rhythm desynchronisation, for example, is longer among field-dependent subjects when the stimulus is auditory but among field-independent subjects only when the stimulus is visual (Pillsbury et al., 1967).

Through the use of various physiological techniques, an elevated level of arousal as well as a greater sensitivity of the autonomic nervous system has been observed in field-dependent subjects. At the beginning of sensory isolation the arousal level (measured by electro-encephalographic readings, electrodermal reactions and heart rate) is elevated for all subjects, but in the course of the experiment, it remains elevated only for those subjects who are field-dependent (RFT and figure drawing test) and who are psychologically the most disturbed by the experience (Cohen et al., 1963; Culver et al., 1964). As a stress producing situation, social deprivation has the same effect as sensory deprivation (Zuckerman, 1968). Put into a situation where it was necessary to detect a lie without stimulation (Block, 1957) and at rest (Hustmyer & Karnes, 1964), subjects judged to be field-dependent by means of the EFT demonstrated a greater frequency of spontaneous electrodermal reactions. Among alcoholics, the reduction of dependence through treatment is accompanied by a decrease in the average level of arousal (Chess et al., 1971). Such results are consistent with the interpretation proposed by Elliot (1961) but still do not invalidate the currently accepted interpretation of a field articulation dimension.

The characteristics of field-dependent subjects that have just been noted are functions of the situation, and in certain cases, probably of the significance of that situation for the subject. Elevated arousal levels and increased discriminatory abilities have been observed for field-independent subjects during learning trials no matter what measurements were used (Heil et al., 1965; Courter et al., 1965; Fitzgibbons & Goldberger, 1971). Moreover, the cardio-vascular and electrodermal reactions which follow adrenergic stimulation (insulin and epinephrine injection) are clearer in field-independent subjects (A. J. Silverman et al., 1967; A. J. Silverman & McGough, 1969). Further, McGough et al., (1965) found that among field-independent subjects, an injection of saline was followed by a greater increase in the level of fatty acids in the blood as well as by an equally significant rise in electrodermal

activity.

Witkin and Oltman (1967) after having examined studies of this sort, have concluded that the field-dependent individual has a smaller number of adaptive possibilities than his field-independent counterpart. The arousal level of the former, once elevated, does not change as a function of the demands of the situation as it does with the latter. H. S. Goldstein et al., (1970) support such an interpretation. In an examination of the patterns of physiological response in a task of visual detection, they note first, that during the course of the task, there is an increase in spontaneous electrodermal activity and a diminution in heart rate for all subjects, but that at rest, electrodermal activity is more intense for those subjects shown to be field-dependent by the RFT. As the task begins, however, the elevation of these indices is more rapid for field-independent subjects for whom there has also been observed a more rapid decrease in heart rate.

It is difficult to interpret the dimension in terms of a simple dominance of the sympathetic nervous system by the parasympathetic. Simultaneous examination of electrodermal responses and heart rate of subjects during conditioning to color seems to indicate that among field-independent subjects there is a simultaneous conditioning of sympathetic and parasympathetic activity, while among field-dependent subjects only sympathetic activity undergoes conditioning (Hein et al., 1966).

Relationship with Pavlovian Typology.

As has been suggested by a part of the preceding results, it is possible to interpret the dimension identified by Witkin by means of factors derived from a Pavlovian typology. When, during the conditioning of the electrodermal response to color, only one color in five is reinforced, field-independent subjects (RFT) who respond most strongly to the reinforced stimuli are situated relatively closer to the strong end of the intensity dimension of nervous reactions than are field-dependent subjects (Hein et al., 1964) (c.f. fig. 3).

The equilibrium between excitation and inhibition is less among field-independent subjects for whom, during extinction, the difference between the intensity of responses to the reinforced stimuli and to non-reinforced stimuli is greater than for the field-dependent subjects (fig. 3). The same result was achieved by Courter et al., (1 65) where in conditioning the electrodermal response to sound generalization of the conditioned response was clearly stronger among those subjects selected for their field dependence ina hidden figures test. Loveless (1972) obtained similar results by calculating numerous correlations between measures of cognitive style and characteristics of orientation reflex conditioning representing the equilibrium of processes within the nervous system.

The relationship with the third dimension of Pavlov, mobility, and perceptual flexibility, especially as evaluated by a hidden figures test,

has been studied by Mangan (1967 a & b). Mobility is measured by the speed of induction and the duration of the effects subsequent to cessation of Plateau's spiral. There is, for the second indicator only, a significant negative relationship between flexibility and mobility. In other words, insofar as the trace is less persistent, flexibility is that much greater. Anderson and Ruuth (1971), using the RFT with young children were not able to replicate this result.

Cerebral Dominance.

In general, subjects with cerebral lesions are very field-dependent (Trites, 1969; Goldstein et al., 1970, for example), thereby leading to an attempt to interpret field dependence in terms of cerebral malfunction. At first, a malfunction of the right hemisphere which plays an important role in the control of visual-perceptual processes was hypothesized (Berent & A. J. Silverman, 1973) but this has not been confirmed. Several facts led to the attribution of a dominant role to the left hemisphere whose dominance for language has been well established (Berent, 1974). Electroshocks applied to the left hemisphere have resulted in an increase in field dependence as measured by the RFT among depressed subjects, but when applied to the right hemisphere, have not had any result (Cohen et al., 1973). Moreover, it is known that field-dependent subjects are more frequently left-handed or poorly lateralized (Oltman & Canobianco, 1967; Adevai et al., 1968b); they exhibit reading difficulties more often (Stuart, 1967) and perform less well on verbal learning tasks (Berent, 1974). Some evidence suggests that a lesser hemispheric asymmetry exists among field-dependent subjects.

Several general hypotheses have been presented in order to account for field-dependence-independence in terms of neurological processing. Witkin and Oltman (1967) have speculated that, at the cortical level, there could exist interference effects that would be isomorphic with those observed at the perceptual level. Gardner and Moriarty(1968) have hypothesized feedback mechanisms dealing with facilitation-inhibition in which the reticular formation would play a decisive role.

V. Field Articulation and Other Cognitive Functions

Perception.

As a perceptual process, field articulation has been compared to other such processes, primarily in order to clarify its significance (Witkin et al., 1962). In Thurstone's factor analysis (1924) the factor structural flexibility that can in a broad sense be identified with field dependence is not independent of other cognitive factors. With three, it even maintains far from negligible correlations: .38 with speed and strength of closure, .28 with speed of perception and .23 with an impure factor dealing with susceptibility to illusions.

Field-independent subjects are more resistant to optical-geometric illusions (Immergluck, 1968). Pressey (1967) has observed correlations .40 to .50 for boys between the RFT, the EFT and Poggendorf's illusion,

the last of which he proposes to consider as a measure of field dependence. A sensitivity index constructed with 37 illusions correlates strongly with the EFT and the personality variables usually associated with field dependence. A sensitivity index constructed with 37 illusions correlates strongly with the EFT and the personality variables usually associated with field dependence (McGurk, 1965). Often, however, these illusory effects do not seem to justify an identification of field articulation and susceptibility to illusions. Thus, in imitation of Thurstone, a factor, "illusion susceptibility" continues to be used (Hettema, 1968, for example). Moreover, the relationship with field dependence is not valid for all illusions. Gardner (1961), prompted by the work of Piaget, has shown that susceptibility to illusions of the Muller-Lyer type which are associated with field articulation, is not connected to a susceptibility to illusions such as the reversed T. Individual differences in the modality of exploration of the field would seem, however, to account for this variability.

The Rorschach test is frequently used in studies of field dependence--either as an objective test of perceptual organization and differentiation (Poddel & Phillips, 1959, for example), or as a predictive test of personality whose validity is implicitly accepted. Relatively few studies utilize field dependence as a validation criterion for the answers and the scores on the Rorschach test although this would be a means whereby the test could clearly be improved as has been shown by studies on the "white space" responses and by inner resonance. White space responses are a sign of field independence as they indicate lesser figure saliency and can thus become the background(De Konninck & Crable-Declève, 1971). Field-independent subjects have, moreover, the possibility of controlling the speed of alteration of Necker's cubes (Haronian & Sugerman, 1966). Classification according to the introversion-extraversion dimension which defines inner resonance from the report of the number of responses "movement" or the number of responses "color", is a cross-check in part of the classification field-independent-field-dependent on the EFT (Bieri & Massereley, 1957).

Learning and Memory.

In general, field-independent subjects perform better no matter what the type of learning involved--verbal (Long, 1962; Berent & Silverman, 1973), numeric (Gardner et al., 1960), maze (Gorman, 1968) or anagrams (Bloomberg, 1965). The analytical set is most often advantageous in those types of learning where it is necessary to eliminate interference. The superiority of field-independent subjects can also be explained by the fact that they are much more centered on the task while field-dependent subjects are somewhat distracted by peripheral stimuli, especially of a social nature (Fitzgibbons et al., 1965). This superiority manifests itself only under certain conditions such as optimal motivation in tasks dealing with verbal conditioning (Dargel et al., 1971) and a moderate degree of difficulty in perceptual-motor tasks (Becker et al., 1971). Although these differences in performance have been more frequently studied, nevertheless, little attention is paid to the quality of individual differences. A different tack has recently been taken in work on learning styles. Nebelkopf and Dreyer (1973) have demonstrated that the learning curves for concepts among young children are much more discontinuous for field-

independent subjects. They interpret these results with the aid of incremental and mediational models of concept formation, the latter of which permits a better understanding of the discontinuities.

Problem Solving.

It is in this area that discussion of the interpretation of the dimension are the most heated and contradictory results most frequent. The obvious empiricism present in the definition of the best solution in problem solving situation is without a doubt not the only incriminating factor. It is also likely, as we will see in regard to creativity, that a multidimensional conception of cognitive style would remove many of these difficulties.

a) Insight and attitude change (set). The ability to overcome a confused background as well as the capacity for detaching elements from their context are, of course, advantageous in the resolution of problems requiring the restructuring of the material given and a certain attitudinal flexibility. Measures of field articulation and measures of flexibility, as defined by Guilford or Duncker-type problems, both load with the same factor (Witkin et al., 1962). The extinction of attitudes brought about by the task itself, whether cognitive (Luchins) or more global preparatory activities (Uznadze), is faster among field-independent subjects (Witkin, et al., 1962; Hritzuk & Taylor, 1973) and personal attitudes react in the same manner. These conclusions need, however, to be differentiated, since, if cognitive aspects of perseverance tasks are eliminated, the relationship between rigidity and dependence is found only among girls (Breskin & Gormin, 1969).

b) General intelligence. Strong positive relationships between field independence and IQ have been consistently observed (with the exception of measures based on the RFT alone). Witkin et al., (1962) report correlations of .55 and .73 in groups of boys and of .76 in a group of girls between the WISC and an indexical measure combining scores on the RFT, BAT and EFT. As a result of findings such as these, a general cognitive-type factor has been proposed in order to account for the correlations between measures of field articulation and other cognitive variables. In this view, performance on tests of field dependence is no longer indicative of a style, but rather of a general level of efficiency. Witkin's group has rejected this interpretation and has produced results that seem to show that only certain sub-tests are responsible for the observed correlations.

It is known that three factors load heavily in the WISC subtests--verbal comprehension, attention-concentration and an analytical approach to the field (Cohen, 1959, for example). Tests of field dependence load for the most part with the last factor (Table V) as represented by the block design, object assembly, and picture completion subtests (Goodenough & Karp, 1961). By using a figure drawing test among older subjects to determine field dependence, Faterson and Witkin (1970) obtained similar results: a correlation of .55 with the analytical approach factor and non-significant correlations (.20 and .00) with the factors of verbal

comprehension and attention-concentration. Under such conditions it is understandable why Witkin does not control for IQ although other authors have insisted strongly upon the necessity of such a control. It must be noted, however, that Witkin's argument ignores the existence of a second-order factor in the WISC. If this "general" factor (whose meaning is necessarily ambiguous since there are no criteria for task sampling) is highly verbal, it is not any the less important in the factor of analytical learning: from .30 to .60 according to age groups in Cohen's (1959) analysis.

c) Aptitude. Using verbal material, such as Guilford's camouflaged words (Guilford et al., 1957) and Poddel and Phillips' anagrams, tests similar to the EFT have been constructed. Now, however, the task is to discover a known verbal element within a verbal masking context. Performance on these measures is unrelated to field dependence as are those results obtained by using conversational and projectional methods to evaluate verbal expression (Witkin et al., 1962). This does not however necessarily mean that the hypothesis of general differentiation is inapplicable in the verbal domain, and indeed it is difficult to see why this would be so. At different times and using different groups, significant positive correlations have been found between field independence and the verbal portion of the WISC (Crandall & Sinkeldam, 1971; Wachtel, 1968; Dreyer et al., 1971) or other verbal tests. It is probable, as has been suggested by Witkin (1962) that taking into account situational characteristics (degree of constraint for example) would help to illuminate the situation.

There is, of course, a relationship between field dependence and the well known visual spatialization factor S (or $V_z$) found in psychometry. It would be a mistake, however, to simply assimilate the two since, in Thurstone's (1944) study, structural flexibility correlated at only .40 with S (the correlation with W is on the same order--.38), and this relationship was less systematic than could have been surmised. Carlier (1972) has, for example, shown that among girls, field dependence (measured by a hidden figures test) and visual flexibility do not correlate. Thus it is hardly surprising that factorial analyses have separated out two distinct factors (Adevai et al., 1968b; Gough & Olton, 1972). Here once again is found the recurrent problem of a variable pattern of correlations depending upon the indicator used, with the EFT loading more heavily on S than the RFT (Gardner, et al., Vernon, 1972). In general, field-independent subjects score better on reasoning tests. R is closely related to structural flexibility, to such a degree that it is an indicator of it (Thurstone, 1944; Pemberton, 1952). But here again this relationship has not proved to be systematic (Gardner et al., 1960 for example). The correlation between field dependence-independence and general intelligence on the one hand, and aptitudes on the other, have led certain authors to incorporate the dimension within factorial models--a practice which is somewhat debatable.

Vernon (1972) has shown that the correlation between spatial and perceptual tests and indicators of field dependence are greatly reduced if g is held constant (g being defined here by tests of non-verbal reasoning). The remaining variance is accounted for by factors from group S or

or k. Thus the part designated by a field articulation factor is insignificant. As there is a considerable overlap of variables the reverse of this procedure would also be justified. Field dependence-independence could be considered as a general factor with another variable sample. It seems to us, however, that in both cases, attempting to integrate the dimension of field articulation into other static models will lead to the reduction of the concept of style to that of aptitude, and, for the moment at least, it would instead be preferable to carefully distinguish the two.

d) Creativity. In general moderate relationships have been observed between creativity and field dependence. Spotts and Mackler (1967), in a systematic study of the subject, obtained mean scores for creativity that were slightly higher among subjects shown to be field independent on several forms of the EFT (creativity being evaluated either verbally or non-verbally), no matter what sub-dimensions were used (flexibility, elaboration, originality, or fluidity). McWhinnie (1967), however, using the figure drawing test and the EFT, observed significant relationships with the dimension for originality and elaboration alone. Numerous personality traits are related, equally moderately, to both creativity and field independence: for example, lack of conformity, a high level of incidental learning, and a weak maternal identification on the part of boys, etc. (Bloomberg, 1967).

After having completed a task analysis and noting that subjects with an analytical aptitude could at times be handicapped in their performance on tests of creativity, Bloomberg has suggested that the weakness of the relationships observed could be explained by a failure to control a factor, present in Werner's general model, but absent or at least secondary in Witkin's. Basically, Witkin retained Werner's concept of differentiation while hardly utilizing that of hierarchical integration as it relates to the relationship between levels; the passage from one level to another being effected with varying flexibility. The concept of differentiation presupposes several functional levels, corresponding to Werner's successive developmental events, and is thus a prerequisite to hierarchical integration. It is only at a high level of differentiation that a large variety of behavioral organizational patterns is possible. Highly differentiated field-independent subjects are able to function continuously at an analytical level, or when circumstances dictate, they can adopt a global mode of functioning. From this point of view, people can be situated along a continuum identified by poles of flexibility and rigidity or of mobility and staticity. In other words, schematically, there may only be one way to be field dependent, but there are two ways to be field independent. It could be expected that subjects who are both field independent and highly flexible would be more creative, but there is no reason to expect the same outcome for subjects who are characterized by field independence and rigidity.

Bloomberg believes that it is possible to identify the mobility-staticity continuum with Rokeach's (1960) concept of dogmatism. Rokeach, whose work resembles research done on the authoritarian personality (Adorno, Frenkel-Brunswick), distinguishes rigidity, which is resistance to change in simple attitudes or beliefs, from dogmatism, which is a resistance to change in complex attitudinal and belief systems. Such a dimension has the hallmarks of a cognitive style. In terms of perceptual activity, subjects who are

either high or low in regard to dogmatism could be differentiated according to their synthetic capacities but not according to their analytic ones (Levy & Rokeach, 1960).

Operationally, dogmatism is measured through the formal characteristics of social attitudes. There have been attempts, for example, to define the degree of isolation of a belief system in relationship to other systems, or the differences between the degree of differentiation of the system that had been adopted as opposed to those that had been rejected. The relationships between dogmatism and field independence-dependence are far from obvious (Hellkamp & Marr, 1965), which, taking into consideration the preceding evidence, is hardly surprising. Bloomberg's hypothesis has been confirmed, most notably by Ohnmacht & McMorris (1971) who have demonstrated that creativity was maximal among field-independent but non-dogmatic ones.

The preceding remarks have gone far beyond the studies done on creativity. By introducing the idea of ease of movement from one level of functioning to another, an idea which is only taken into account in a limited and imperfect fashion by the theory of dogmatism, one moves away from a monofactorial conception of field dependence-independence and toward Werner's model. A distinction between two types of field independence has been proposed by Witkin in order to account for the variability of reactions to psychotherapy, and although this interest has been followed up several times (notably by Haronian and Sugerman, 1967), as of now, it has not generated a great deal of research.

e) Operational thought. For the moment, there is little work connecting field articulation to the operational theory of intelligence, although a strong interest has begun to surface in regard to this question. There have been efforts to find parallels between operational development and degree of differentiation as defined by Witkin, in that, for a given age, conservation has been more frequently observed in field-independent children (Zimiles, 1966; Fleck, 1972). But once again, the observed relationship is moderate and needs to be further refined in view of the nature of the tasks used to determine the operative level. Saarni (1973), for example, has shown that the ability to solve detective-type problems is related to the operative level but has no relationship with field dependence.

The few studies which have attempted to show that developmental modalities are a function of individual traits, although difficult to interpret, are more interesting insofar as they do not simply reduce individual differences to developmental ones. O'Bryan and McArthur (1969) have administered numerous tests of conservation that lend themselves to quantitative evaluation. A factorial analysis of between-test correlations has demonstrated that two of the factors correspond to two types of reversibility: class reversibility or inversion (tests that load on this factor imply classification) and relational reversibility or reciprocity (tests that load on this factor presuppose reference to a model and the transformation of it). These two factors are practically independent ($r = .08$). The first factor (inversion) shows a better correlation with tests of creativity (fluidity, flexibility, originality and elaboration) than with tests of intelligence (Otis verbal and non-verbal, progressive matrices and hidden figures). For the

second factor, exactly the opposite occurs. Hidden figures, similar to the EFT and hastily assumed to be an intelligence measure, correlated much more strongly with the factor of reciprocity than with the other tests of intelligence.

The development of this type of work (it being conceivable, for example, that field-independent and field-dependent subjects would not furnish similar justification for their responses or that they would not choose the same alternative in conflict situations with equivalent outcomes), and especially their interpretation, are, it would seem, largely dependent on conclusions drawn from theorizing on the relationship between Witkin's progressive differentiation and Piaget's successive decentrations. Pascual-Leone has proposed a neopiagetian theory of cognitive operations in which the construct of field articulation holds an important place. This complex theoretical concept presupposes the existence of five factors which act upon the assimilative capacity of the schema that the subject applies to the situation-problems encountered: a learning factor, possible "mental effort" (corrresponding to level of development), capacity to function at maximum efficiency, weight given to perceptual cues and an affective factor. Within this perspective, field-dependent subjects do not function at maximum efficiency and depend more on perceptual cues. Pascual-Leone has demonstrated that difference in performance on Piagetian tasks between field-independent and field-dependent subjects is a function of the nature of the tasks themselves.

## VI. Field Independence and the Non-Cognitive Aspects of Personality

### Initial Research.

In 1954, Witkin et al., reasoning from the analysis of functions implied by perceptual tests and from the first differential results, elaborated a series of hypotheses on the relationship between field independence-dependence and several aspects of personality. Throughout the conception of these hypotheses, the importance of the postural-sensorial distinction in bodily function as well as the frequent reference to psychopathology must be kept in mind. Since field-dependent subjects do not take postural information into account, it is suggested that they will more frequently employ repression as a defense mechanism in reference to the body, and that their ego identity will be less defined than that of field-independent subjects. Field-independent subjects, on the other hand, will tend to ignore visual information, a characteristic which can be associated with autistic tendencies and a high level of narcissism. Since they resist the pressure of the field, it can be expected that they will adopt an active stance in order to coordinate and resolve two contradictory stimuli.

Such hypotheses have not been individually verified, but rather, using them as a base, researchers have constructed configurations that could be globally verified. The scale constructed from interview protocols, for example, is made up of five opposing items which are, in fact, broad and fairly fluid personality dimensions:

1. Degree of self-awareness or capacity for self-observation;

2. Manifestation or repression of agressiveness;

3. Active or passive attitude in daily life;

4. Degree of compensation for feelings of inferiority;

5. Degree of self-assurance during the interview.

After having established the coherence of the items, it was shown that field-independent subjects as opposed to field-dependent subjects have better self-awareness, exhibit their agressiveness more, are more active, compensate more effectively for inferiority feelings and have more self-confidence. In the same way, the Rorschach tests, the TAT and figure drawing tests as well as, for young children, observation of play, were processed. The items on the scales are either gross objective indices (the frequence of various types of responses to the Rorschach for example) or clinical interpretations. Such scales correlated strongly with field articulation. For the scale established on the basis of interviews, for instance, correlations for males and females respectively were as follows: .62 and .47 with the RFT; .56 and .60 with the TRTCT, and .46 and .47 with the EFT. These correlations are extremely strong, on the same level as the correlations between indicators. Such observations are, however, certainly influenced by the fact that observer reliability may have been biased by previous knowledge of cognitive style and thus elevated.

In a summary of their five-hundred page report of research, Witkin et al., group the individual observed differences into three broad areas. The definitive character of these portraits should not lead to illusory conclusions as they are the extreme poles of a dimension, and, in fact, indicate tendencies only.

1. The relationship of the individual with his environment. Field-dependent subjects are passive whereas field-independent subjects are active. This activity-passivity dimension is, in large part, indicative of an ability to do without secure surroundings, the relative degree of initiative corresponding to the possibility of resisting exterior constraints.

2. The relationship between the individual and his impulses. As opposed to field-independent subjects, field-dependent subjects are only dimly conscious of their inner life and fear sexual and agressive drives over which they have little control. The result is anxiety.

3. Self-evaluation. Among field-dependent subjects, again relative to field-independent subjects, there is weak self-esteem, difficulty in self-acceptance and a lack of confidence in one's body. The body schema of field-independent subjects is more highly differentiated and better integrated.

These results are valid for mixed adult groups, groups of normal children, and groups of mentally ill adults.

Subsequent work, and especially that conducted by others than Witkin and his group, tends toward a more analytical perspective, clarifying, developing and sometimes, calling into question the results that have just been discussed. Along with the inevitable overlapping, four broad categories can be differentiated along the lines of type of approach and personality factors considered: personality traits, defense mechanisms, psychopathology and social behavior.

The hypotheses guiding these studies have frequently, and to varying degrees, been inspired by the notion of differentiation. Occasionally they have been based on analogies and even metaphors, as in the assimilation of the frame of the RFT to the frame of social reference! Certain studies seem to have been done in the absence of any hypothesis whatsoever. Dana and Goocher (1959) calculated 95 correlations between personality traits and assumed measures of field dependence. Witkin (1960), after having specifically criticized the choice of measures of field dependence, and the absence of selectivity with regard to personality variables in this study, notes that, on the basis of the hypotheses offered, nothing but significant correlations could have been expected.

Observed results are sometimes contradictory and seldom clear-cut--a fact that the preceding remarks, even when added to the uncertainty of measurement in the domain of personality, do not adequately serve to emphasize. We will see that in certain cases, as in the cognitive area, a multidimensional conception of style can help to clarify some of the ambiguity.

Dimensions of Personality.

In 1962, Witkin et al., fragmented the overly global concept of activity, which had occupied an important place in the 1954 work, into the psychosocial elements which will be dealt with shortly, elements relative to self-assertiveness and psychomotor elements. Tonus and posture, insofar as they correspond to states preparatory to motor activity, are related to field dependence, field-independent subjects having a more assured posture (better body equilibrium, a straight but not rigid stance, etc.).

Notable differences appear between field-dependent and field-independent subjects in the degree of structuration applied to their daily existence. This degree of structuration, or cognitive clarity, has been evaluated on the basis of interviews whose major emphasis has been family relationships, leisure, schools, job choice, and present problems. This evaluation of cognitive clarity has been effected from various points of view: consciousness of the relationship between ends and means, precision relative to time and space, consciousness of one's own motivations and those of others, interest and effort toward informing oneself, clearness of questions asked and pertinence of responses given as well as capacity for generalization and abstraction. So defined, cognitive clarity is greater in direct relationship to field independence as measured by the RFT, BAT and EFT. Certainly, as Witkin and his colleagues have noted, this concept requires a substantial amount of clarification and an increased degree of

refinement. Conclusions of the same sort have been reached through examination of subjects' responses to Kelly's REP test and to the Rorschach.

Need achievement, which can be considered as an index of activity, is far from being systematically linked to field articulation. However, according to both Witkin and McClelland, these two aspects of personality have a common origin--the coercive character of educational practices being cited as responsible for both a tendency toward field dependence and a weak development of need achievement. Moreover, these results seem to be largely a function of the modality measured. By using McClelland's projective techniques, Wertheim and Mednick (1958) obtained a correlation of .40 between the two variables. In an examination of TAT protocols for selected items, Witkin et al., (1962) noted stronger self-assertiveness among field-independent subjects who, moreover, did not exhibit a particular desire to overcome their failures. Crandall and Sinkeldam (1964), by observing the behavior of young children and rigorously controlling for age and intelligence, obtained significant results in the same direction. However, using paper and pencil tests, this relationship was not observed. The need-for-success scale in Edward's EPPS did not appear to be related to the field independence-field dependence dimension in studies done by Dana and Goocher (1959), or by Marlowe (1958), and only slightly in those of Gardner et al., (1960). The above studies, with the exception of Gardner's, used only the EFT. Thorton and Barrett (1967) replicated Wertheim and Mednick's results. The observed relationship was found only among girls, and, (Honigfeld & Spiegel, 1960) for this same group, the EFT correlated so weakly with the RFT that they could not be considered to indicate field dependence, according to the authors. The final conclusion was that there is no relationship between dependence-independence and need achievement. This conclusion is laudable in that it considers simultaneously both the specificity of the indicators and a mediating variable. It is, however, not decisive. In a study conducted by Crandall and Sinkledam (1964) the intersex differences are negligible, while in Gardner et al.'s study of girls, the RFT and not the EFT correlated best with a need for success.

In Cattell's 16PF, a second-order factor (factor IV), defined by poles of submission and independence, appears to correspond to an appreciable degree to the dimension activity-passivity. This factor correlated with the RFT only within a male population (Johnson et al., 1969) but did not correlate with the EFT (Ohnmacht, 1968). These results seem to indicate a fair amount of independence between the two dimensions. This conclusion is, however, contested by Cattell (Cattell & Hundleby, 1968; Cattell, 1969) who justly directs his criticism first at the extremely frequent practice of defining a factor by a single test. He goes on to stress the nature of factors: Factor IV corresponds to a restricted surface characteristic and it is only by means of a trait that can be evaluated both by pencil and paper and objective tests that it is reasonable to envisage a relationship between these two modalities of independence. Cattell suggests, with caution, an interpretation of field independence-dependence reminiscent of Vernon's g and S. When considered as a surface characteristic, the dimension would be again absorbed by a more general factor, here Independence-UI 19.

A positive relationship between field dependence and extraversion as defined by Eysenck has been hypothesized. Several results have confirmed this. Evans (1967) has reported significant correlations between field dependence as evaluated by the EFT or by drawing and extraversion; Seel and Duckworth (1974) have shown that the EFT and the RFT contribute significantly to the production of extraversion scores; and in factorial analyses, extraversion and field dependence appear to load on the same factor (Bone & Eysenck, 1972; Mangan, 1967b). But, these two dimensions were in all probability too hastily assimilated by Eysenck (1967). The relationships reported above are fairly weak and moreover, the findings are far from being systematic. Insignificant correlations have been reported by several authors for various groups with the RFT and with diverse forms of the EFT as indicators of field dependence (Franks, 1956; Château, 1959; Dupreez, 1967; May & Bell, 1972). Relationships have been found (using, it is true, a definition of extraversion that differed noticeably from that of Eysenck) that are in the opposite direction (Kato, 1965b). Such ambiguity is not found with regard to neuroticism, which has never been found to be related to field dependence. Fine (1972) has proposed a model relating Eysenck's two dimensions and dependence-independence. Neuroticism, in this perspective, would not be a basic trait such as introversion-extraversion, but rather the product of interaction between basic traits, cognition, needs, and environment. This model assumes no relationship, or at least a weak one, between extraversion and Witkin's dimension. Field-dependent subjects need social stimulation, and introverted subjects are for the most part social isolates. Field-dependent subjects who are also introverted are then in a conflict situation, and Fine puts forth the hypothesis that neuroticism is a manifestation of this conflict. In a re-analysis of existing data, he demonstrated that N scores are very clearly higher among field-dependent introverts than in other groups composed on the basis of an interaction of the variables introversion-extraversion and field dependence-independence.

The total sum of these results is deceptive, but that is hardly surprising. To simply postualte a relationship between a perceptual characteristic and a personality trait (whose definition is often only instrumental) is the reinstatement of an abusively simple concept of personality formation. These eventual relationships can obviously be established only under certain conditions--precisely those conditions that remain to be discovered. Relationships with defense mechanisms, as will be seen, are much clearer apparently because defense mechanisms are much deeper personality structures.

Defense Mechanisms.

Since they are more differentiated, field-independent subjects are less sensitive to interference between perception and emotion, and it will be possible for them to hold the latter at a distance. They can be expected to use such elaborate and specialized defenses as isolation and intellectualization. On the other hand, it can be surmised that field-dependent subjects will more frequently utilize more primitive and global responses such as denial or massive repression. Klein and Gardner as well as Witkin have emphasized the similarities between defense mechanisms and

cognitive controls. As these two types of structures mediate between the needs of the subject and his conduct, an adaptive function has been attributed to them, they can be objectivized on the basis of cognitive function and it is possible that they call into play the same mental mechanisms.

The degree of defense structurization, globally evaluated on the basis of projective tests, is fairly strongly associated with degree of independence as evaluated by Witkin's perceptual index (Witkin et al., 1962). The more primitive character of the defenses of field-dependent subjects has been inferred on the assumption of lesser possibility of impulse control on their part--notably control of agressivity-- and of their greater anxiety. The control of agressivity, as assessed by selected items on the TAT, is only weakly associated with field independence (Witkin et al., 1962). Moderate relationships along these lines have been observed when control is judged according to behavioral observation (Ladkin & Barker, 1972), and by rating scales (Gordon et al., 1961). On the other hand, field-dependent and field-independent subjects do not seem to be differentiated in their sensitivity to failure, at least in tasks where the implications of failure are minimal (Gilles & Bauer, 1971). Results relative to the expression of anxiety are more ambiguous. Adevaï et al., (1968a) make much of a correlation of .36 between the RFT and Taylor's anxiety scale, but Gordon et al., (1961) utilizing other anxiety scales with the EFT, and Stuart and Bronzaft (1970) with the RFT, found no significant relationship. Iscoe and Carden (1961) found a relationship between field dependence and anxiety only among girls.

Denial (refusal to recognize the reality of an unpleasant perception rather than the active avoidance of it) has been evaluated by Witkin et al., (1962) through the use of a portion of the TAT. For example, the absence of reference to a violin in the story occasioned by the first picture would be such an indication. Denial is more frequent among field-dependent subjects. Gardner and Moriarty (1968) in the course of a global and blind examination of projective test protocols did not find such a relationship. On the other hand, repression, the sole significant relationship for the six defenses studied by Gardner and Moriarty was the most marked among subjects evaluated as field-dependent on several forms of the EFT.

The cold and distant character of numerous field-independent subjects, along with their greater emotional control, indicates for certain researchers, a larger use of intellectualization as a defense mechanism. The relationship between field independence and intellectualization (intellectualization being again measured by projective tests) has been observed several times (Witkin et al., 1962), Schimeck's (1968) longitudinal study being without a doubt the most complete of the group. An intellectualization score, derived from Rorschach responses took into account the clarity and precision of the answers, the productivity and variety of responses, and the judgments of the subject regarding his responses during administration. The degree of agreement between two independent observers and the test-retest stability of the subjects' scores was verified. The magnitude of the validity coefficients (Table VII) gives Schimeck's work particular interest but the results do not resolve the more central problem of the

exact nature of the measure: is it satisfactory, for example, as done in this study, to include cognitive clarity within intellectualization?

Intellectualization scores are elevated in proportion to lack of error on the RFT (Table VII). This type of result is not based on projective techniques. Broadly similar results have been obtained for the major indicators of field dependence by the use of a paper-and-pencil inventory to evaluate the dominant defenses of the individual in a study constructed especially to examine the relationship between defenses and cognitive styles (Gleser & Ihilevich, 1969). This inventory, whose validity seems satisfactory, evaluates five large classes of defenses based on the responses of subjects to questions about stories that set up different types of conflicts. The defenses of field-dependent subjects were more global (direction of aggressiveness against one's self, negativeness, denial and repression) and those of field-independent subjects more differentiated (intellectualization, rationalization, direction of aggression toward an object, displacement and identification with the aggressor). Atypical subjects as far as defense mechanisms are concerned are those whose performances on field-dependence tests were average. A final examination of defense mechanisms showed that (although) it may be possible to predict field dependence from such mechanisms the reverse is certainly not true. Groups of defense mechanisms rather than specific types are associated with field dependence. The determination of defenses by perceptual styles, if such an hypothesis were to be admitted, could only, then, be relative (Bogo et al., 1970; Ihilevich & Gleser, 1971).

Further experimental studies have confirmed, to a certain degree, Witkin's hypotheses. The greater inability of field-dependent subjects to hold their emotions at a distance appeared in Minard and Mooney's (1969) study of perceptual defense. With field dependence being evaluated by the BAT, the EFT and the figure-drawing test, the recognition thresholds for anxiety-producing words which were presented tachistoscopically were higher for field-dependent subjects than for field-independent subjects, while there was no difference when neutral words were used. The recognition thresholds of the anxiety-producing words correlated with the inability to control emotions in a clinical interview situation. In learning tasks, field-dependent subjects had retention scores inferior to those of field-independent subjects when the material to be memorized was anxiety producing (Uhlman & Saltz, 1965). The repression of unpleasant stimuli is thus more marked in perception as well as in learning among field-dependent subjects. The more numerous and older studies, those dealing with the forgetting of dreams (some of which were conducted by Witkin's group) assume that such forgetting can be taken as a sign of repression. This assumption has been partially validated through clinical data where it has been observed that field-independent subjects report their dreams more frequently. Under controlled laboratory conditions, stress preceding sleep (films of surgical operations, for example), had different effects on field-dependent and field-independent subjects as distinguished by the RFT, the BAT, the EFT and the figure-drawing test. Field-dependent subjects, although they dreamed as much as field-independent subjects (as shown by ocular movements) remembered distinctly fewer dreams. Such a difference was not observed when the stimulation preceding sleep was

neutral (Goodenough et al., 1974). Moreover, when stress preceded sleep, differences in the content of dreams among field-dependent and field-independent subjects have been documented. Baekeland (1971) notes that the roles taken by field-dependent subjects in their dreams are relatively ambiguous while those taken by field-independent subjects are more active. However, these differences, which correspond to the respective personality characteristics of both types of subjects, do not lend themselves to an interpretation based on repressive mechanisms.

Psychopathology.

Witkin (1965) has reviewed the research on psychopathology inspired by this theory of differentiation. Cases of maladjustment have been found both among the field dependent and the field independent--a reminder that there is no correlation between field dependence and neuroticism. A strong degree of maladjustment represents an extreme degree of either field dependence or field independence. Although not yet accepted by all researchers, it is probable that psychopathological problems are more frequently seen among field-dependent subjects. In a survey of 238 hospitalized patients, three times more extremely field-dependent subjects (mean error on the RFT above $10^{o}$) were found, while in the same group, there were less strongly field-independent subjects than in a sample of university students (Nerville et al., 1969). The disorders from which the patients suffered also differed according to whether the patients were field dependent or field independent.

Among the latter, delusional psychosis, intense ideational activity and an exteriorization of aggression are more frequently encountered. Patients with a tendency toward paranoia and obsessive neuroses are more often field dependent. Field-dependent patients, who are only slightly differentiated, often have problems of identity and frequently exhibit symptoms of passivity and inadequacy of control. These disorders, as can be seen, constitute an accentuation of the tendencies observed among normal subjects.

A great deal of work has been directed toward mental disorders as they relate to field dependence. It has been shown that strong field dependence is quite frequent among alcoholics, asthmatics, the obese, ulcer patients, enuretic children, hysterics and, in general, all those who somatize their problems. Alcoholics, due to the social importance of their problem, have been widely studied, and a recent bibliography can be found in Bergman and Agren (1973). Groups of alcoholics are systematically and distinctly more field dependent than the control groups to which they have been compared, whether men or women, whatever the degree of intoxication and whether or not the subjects have been under the influence of alcohol. Likewise, former alcoholics are more field dependent. Obviously, the important question is whether, as Witkin's theory suggests field-dependent subjects have a personality which predisposes them to alcoholism, or whether field dependence is merely a consequence of alcoholic intoxication and a result of deterioration of cerebral mechanisms (Goldstein et al., 1970; Goldstein & Chotloss, 1965). A decisive answer to this question presupposes longitudinal studies dealing with vast samples of randomly chosen subjects--studies so costly that to our knowledge they have not been undertaken. The study of the correlation between field dependence and the length of time one has been

an alcoholic have, up to now, furnished contradictory results and have not shed light upon this question. Bergman and Agren (1973) found no relationship between field dependence and degree of alcoholism as measured by a series of symptoms--a result which tends to confirm Witkin's hypotheses. The degree of differentiation is, at best, only a determinant of the disorder. As we have already pointed out in regard to defense mechanisms, a specific disorder can permit the prediction of degree of differentiation, but the reverse is not true. In spite of this lack of exactness, by taking into consideration the field-articulation dimension, it becomes possible to refine diagnoses. Thus, it is useful to distinguish, for example, the relatively few field-independent alcoholics from those who are field dependent.

Field dependence/independence has also been used to distinguish several types of schizophrenia. It should be pointed out that, in the Anglo-Saxon literature, the term schizophrenia has a large range and designates disorders that in France are often more specifically differentiated, for example onerism, mental confusion, paranoias, etc. It has been observed that in psychotic states, hallucinations are much more frequent among field-dependent subjects, while delusional psychoses are more often seen among field-dependent subjects (Taylor, cited by Witkin, 1965). This is in agreement with the greater intensity of imagery reported by field-dependent subjects undergoing sensory deprivation (A. J. Silverman et al., 1961) and with similar results obtained by asking subjects to describe whatever comes to mind after visual and auditory fields have been equated (Bertini et al., 1964). The concept of differentiation permits the integration of these findings. The ties between type of manifestation of schizophrenia and field dependence/independence are a function of other perceptual characteristics, notably the extent of visual scan. J. Silverman (1964), attempting a synthesis of this problem, notes that field independence and amplitude of visual explorations are characteristic of paranoid schizophrenics while field dependence and narrowness of visual exploration are characteristic of catatonic schizophrenics and hebephrenics. An average range of visual scan would constitute an optimistic prognosis. Moreover, symptoms develop more slowly, in general, among field-dependent subjects. The bi-dimensional concept of attention to which we have already alluded allows us to understand certain particularities of schizophrenics' performance on the RFT. A good performance can be obtained through field independence or through a limited field of exploration (what we have heretofore called, respectively, sensitiveness to interference and capacity to perceive according to a more or less analytical mode). Since schizophrenics occupy extreme positions on the two dimensions, their performance on the RFT will be distributed according to a U-curve, and the prognosis will be better for those subjects having an average score (Sugerman & Cancro, 1968). Improvement of RFT performance during the course of the disorder on the part of certain subjects results from the reduction of the extent of their visual explorations (J. Silverman, 1968). On the EFT, on the other hand, the prognosis is the same for all subjects: performance decreases as the disorder worsens (Magaro & Vojtisek, 1971). The model proposed by Silverman has been completed by the addition of a third dimension: the intensity with which stimuli are perceived (Schooler & J. Silverman, 1969). Vardy and Greenstein (1972), using a sample of mentally-ill patients, failed to

find the differences predicted by Witkin's hypothesis, and, after an examination of the particularly weak correlation between the RFT and the EFT, suggested that Silverman's model be extended to the domain of psychopathology with which it had initially not been concerned. Whatever the actual scope of the model, it does illustrate once more the value of a multidimensional approach to the concept of style.

Studies of the mentally retarded have shown that they are not characterized by a marked field dependence. Their handicap in the analytic factor of the WISC is relatively less than for other factors. The simple distinction between verbal I.Q. and performance I.Q. does not take into account this heterogeneity. Witkin et al., (1966) have compared verbal and performance I.Q.'s and I.Q.'s established on the basis of three WISC factors, obtaining the following results for two groups of retarded adolescents. (See Table IX)

Social Behavior.

The degree of differentiation in the experience of the subject in his relationships with others is expressed by what Witkin has called "the sense of separate identity." This sense of separate identity implies a strongly structured ego and a stable framework of reference. These two elements permit a psychological functioning that is relatively independent of exterior constraints and assures the stability of self-concept. Thus, it is to be expected that field-dependent subjects will also be socially dependent.

Dependence vis-à-vis the experimenter in test situations is stronger among subjects who are only slightly differentiated. The TAT protocols of such people, show that, relative to those who are more strongly differentiated, they are more prone to ask for clarification and are more likely to depreciate what they have done as well as to experience more frequent anxiety during testing (Witkin et al., 1962). Such a diminished confidence on the part of field-dependent subjects in their ability to respond to the demands of the situation, along with the appeals to the experimenter associated with them, have been observed in situations where the personality of the subject is much less implicated than in the TAT. Alexander and Gudeman (1965) observed this with alcoholic subjects who were asked, for example, to hang pictures in a room or to match names with photographs. Konstadt and Forman (1965) demonstrated the effect of verbal reinforcement (approval or disapproval) on performance in a letter-cancelling task and on the time given to looking at the experimenter among field-independent and field-dependent subjects (measured by the EFT) of about ten years of age. The difference in performance between the reinforcement conditions was notable only for field-dependent subjects, their performance being less when reinforcement was negative.

But, as Konstadt and Forman's experiment suggests, in the absence of constraint, a greater social dependency for field-dependent subjects will not necessarily be found. Crandall and Sinkeldam (1964) observed the behavior of children from 6 to 12 years of age during free play. Three observation scales, corresponding to social dependence vis-à-vis adults,

were used--search for help, search for affection and search for approbation. Relationships with field dependence as evaluated by the EFT were in the expected direction but weak (with age and I.Q. controlled, the only relationship to reach a level of significance of .05 was search for affection). Results obtained from scales of self-evaluation were ambiguous, field-dependent subjects seeing themselves as often socially dependent, and being perceived as such by others at times (Witkin et al., 1962). This is, however, far from being systematic. The need for affection and sympathy, as measured by Edwards' inventory, for example, is not related to field dependence (Dana & Goocher, 1959; Marlowe, 1958; Gardner et al., 1960).

If field-dependent subjects are relatively seldom autonomous in their social behavior, they would be expected to assume a more self-effacing position within groups. Thurstone (1944) has already noted that student leaders are less sensitive than are average students to optico-geometric illusions and more efficient on Gottschaldt's tests. Here, however, we are dealing with a tendency which, although confirmed (Daugherty & Waters, 1969), is not marked. The examination of sociometric choices allows a finer analysis of these phenomena without the possibility of direct extrapolation to actual behavior. Iscoe and Carden (1961) restricted their subjects' choice to their own sex. They found that among children of 11 and 12 years of age, boys chose field-independent leaders, as predicted, but girls did not. Dreyer et al., (1973) replicated these results as early as kindergarten but only in play situations. When there was a job to be done, field-dependent girls were not chosen over other girls. One sees that there remains a complex interaction that is in need of elucidation. Nevertheless, the above constitutes a good example of the fact that social dependence is characteristic of subjects only in relation to situational context.

Experimental situations of the autokinetic type, where the subject must furnish a series of estimations, have been frequently used in the study of social dependence. Adjustments in estimations toward those of a group or toward an expert norm are more rapid and more evident among field-dependent subjects. Negative reinforcement of the first estimates of frequency of a flickering light facilitates conformity to group norms or to partner judgment only among field-dependent subjects (Mausner & Graham, 1970). When two subjects, one field dependent and the other field independent, must adjust the rod of the RFT to vertical together, the final position is very near to that furnished by the field-independent subject. In an individual situation, the field-dependent subject returns to his first estimation (Solar et al., 1969). The greater suggestibility of field-dependent subjects has been observed in varied contexts. In an autokinetic situation, they more frequently read words when it is suggested that the words are written; their scores are higher in Eysenck and Fourneaux's test concerning the suggestibility of forms, odors and weight; they are more apt to modify their opinions after reading texts attributed to authorities; they seem to be (especially boys) more easily hypnotized (Goldenberger & Wachtel, 1973); and, as observers, they are more sensitive to Rosenthal's effect (McFall & Schenkein, 1970). Field-dependent subjects, on scales of self-estimation, are more likely to give responses conforming

to social desirability (Eliot, 1961). This priority of an external framework of reference can lead to a certain instability of self-image. Rudin (1968) asked subjects to describe themselves on Osgood's semantic differential scale under varying conditions and found that the greater a subject's field dependence (as measured by the RFT), the greater his variance of estimation. This result is, however, a function of the instructions given, and subjects who, under certain conditions, exhibit greater resistance to the reference framework, are the same who, under other conditions, take it more into account. Once again, in our opinion, studies such as this, indicate the advantage of distinguishing degree of differentiation from mobility of adaptation. Field-dependent subjects are more conformist, but this does not mean that they will exhibit more authoritarian attitudes. Results on this point are, however, contradictory (Clark, 1968; Baer, 1964; Stuart, 1965; Ohnmacht & McMorris, 1971).

Obviously, there are notable differences in the social conduct of subjects as a function of their position on the dimension of field dependence/independence. Nevertheless, it is without doubt dangerous to interpret all such differences in terms of social dependence or independence, all the more so in that social behavior is multi-determined. The greater amount of attention paid to faces by field-dependent subjects is not necessarily a sign of dependence. Such an interpretation is certainly compatible with results such as those obtained by Konstadt and Forman, and more generally, with observations made during psychological tests. But it is difficult to see how it would account for other observations such as the superiority of field-dependent subjects for face recognition (Messick & Damarin, 1964) or their superior ability for the memorization of stimuli with social significance. This last problem has received particular attention (Eagel et al., 1969; Fitzgibbons et al., 1965; 1971; Goldberger & Gendich, 1972), and shows once more the complexity of the interactions between field dependence/independence (evaluated by various forms of the EFT) and situational characteristics. Thus field-dependent subjects show better incidental learning when the peripheral stimuli (visual or auditory) are social. This is, however, only observed during individual testing, and the hypothesis has been proposed that, in a group situation, the other subjects would, to some degree, take the place of the peripheral stimuli. Field-dependent subjects are more oriented toward social stimuli, and it is thus not surprising that they are very often judged to be more sociable. On the other hand, the ambiguity of the relationship with extraversion previously considered remains a problem. Generally, very unstable relationships between field dependence/independence and various paper-and-pencil, scales of personality are found. Thus one can legitimately wonder if the multiple biases affecting the responses of a subject in these tests render them usable for the domain of cognitive styles (Solar et al., 1969; Adevai et al., 1968a).

Although oriented toward others, it is to be expected that field-dependent subjects will have a less differentiated perception of others. Gardner et al. (1968) asked for descriptions of several people on Osgood's semantic differential scale and found that variance of descriptions was not closely associated with field dependence. In an outside study, Gruenfeld and Arbuthnot (1969) proposed the same hypothesis but specified (on

the basis of remarks of Witkin et al., 1962) two groups of field-independent subjects: one being very distant and cold in their interpersonal relationships and the other being oriented toward social stimuli. In our opinion, this distinction recapitulates, in part, within the social domain, the flexible-mobile dimension whose theoretical importance has already been emphasized. Here, this dimension has been operationalized by a masculinity-feminity scale and it has been verified that, in conformity to the hypotheses, the correlation between the RFT and the variance of peer judgment on several criteria appears only among boys having a high masculinity score. Once again, in regard to this research whose implications for the study of methods of evaluation are very important, the advantage of a multidimensional approach is obvious.

From the accumulated results, it follows that the complex processes of social interaction will be a function, at least in part, of the cognitive characteristics of the participating subjects. Witkin has presented a synthesis of the results obtained and the testable hypotheses for two particularly important areas: psychotherapy (1965) and pedagogy (1973).

## VII. Origin of Individual Differences Within Field Independence/Dependence

We will deal, successively, with the problems of individual differences and then with that of differences between the sexes. In conclusion, we will mention cross-cultural work which, although frequently used in attempts to explain these two types of differences, presents a consistent pattern of results which are congruent with intracultural studies of such differences.

### Heredity and socialization in inter-individual differences.

Individual differences, insofar as field dependence is concerned, are observable among chimpanzees and are associated with physiological and morphological characteristics. Among humans, future differences in field dependence can be predicted on the basis of precocious psycho-motor manifestations, for example, a more violent reaction to the interruption of nursing and less of one to human contact (Witkin & Oltman, 1967). Facts of this nature suggest that the dimension of field articulation could have a constitutional basis.

The comparison of similarities between monozygotic twins and dizygotic twins confirms this hypothesis. Monozygotic twins raised together are more alike than dyzogotic twins raised together whether measured by their performances on the RFT (Vandenberg, 1962) or on the EFT (Stuart et al., 1965). A study of intrafamilial correlations shows that for the S factor, it is possible to envisage a genetic model in which the gene responsible for this behavior is recessive and sex linked, carried on the X chromosome. In fact, it can be stated that the correlations between fathers and daughters and those between mothers and sons are fairly significant, while the father-son and mother-daughter correlations are much weaker (Hartlage, 1970, for example). Moreover, almost the same pattern of correlations for field dependence/independence as measured by the EFT has

been found (Corah, 1965):

| | | |
|---|---|---|
| $\underline{r}$ father-son | .25 | |
| $\underline{r}$ father-daughter | .41 | (significant at .05) |
| $\underline{r}$ mother-son | .39 | (significant at .05) |
| $\underline{r}$ mother-daughter | .00 | |

This pattern of correlation is susceptible to the same interpretation as that given S although the author does not mention the possibility. A study of female subjects afflicted with Turner's Syndrome (only one X chromosome) furnishes another sign of a genetic explanation implicating the X chromosome. These subjects were relatively field dependent according to their scores on the WISC: verbal comprehension I.Q. 112; analytic I.Q. 84 (Shaffer, 1962). Work now in progress, i.e., studies of subjects possessing a supplementary chromosome (either X or Y) and a study of similarity between brothers according to whether or not they received the same maternal X chromosome (see Witkin, 1973), will furnish additional details for the genetic model.

With the exception of several studies of twins, environmental effects have been studied independently of genotype which obviously is impossible to control. It is generally accepted that field dependence/independence is not related to socio-professional category, although it has been observed that subjects from higher social classes have, on the average, scores slightly but consistently superior on the WISC sub-tests which define the analytical factor (Gardner et al., 1960; Cropley, 1964; Karp et al., 1969). In work done with adopted children, Claeys (1973) has demonstrated that a stimulating environment has much less effect on field dependence than do primary aptitudes, with the expected exception of S. Moreover, from the first, attempts have been made to account for these differences through factors contributing to personality development, in particular those factors based on maternal attitude and role.

Witkin et al., and Dyk and Witkin (1965) considered the characteristics of the mother and the type of interaction with the child as favoring or inhibiting differentiation of the child's personality. Among these maternal characteristics, self-realization and self-assurance have been retained. It is assumed that mothers who are satisfied with their familial and extra-familial roles will be more likely to favor the autonomy of their children and that the stability of their behavior will have, as a consequence, the child's superior control of his drives. The child-rearing practices of the mother, for example whether or not she is indulgent or encourages autonomy, will also effect the defense mechanisms and the "sense of separate identity" of the child. In this way, a series of behavioral and attitudinal attributes based on data gathered during interviews was ascertained. Upon this basis mothers could be classified into one of two groups: those who facilitate differentiation and those who inhibit it. Numerous examples of interview coding can be found in Witkin et al.'s work. The biserial correlations between mothers' classification and their children's field independence (BAT, RFT and EFT) are very high (perhaps even too high!) and go in the expected direction: .85 and .65 in two groups of boys ten years old, .82 in a group of 14 year olds. The

examination of these results occasions two remarks. The correlations are probably overestimated. In the course of the interview, indications were certainly given by the mothers about the degree of differentiation of their sons from which derived a bias in estimation of behavior of the sons. The second remark is more general and applies to all work alluded to in this paragraph: these correlations cannot be identified with causal relationships. Upon this point, the longitudinal studies undertaken have not, up to now, been very enlightening. Socially dependent behavior at 2.5 years of age is only slightly related to field dependence at six (Pederson & Wander, 1968), and even if this relationship were clear, it would still be necessary to connect social dependence to child-rearing practices and to specify the derivative ties between social differentiation and perceptual differentiation. In spite of these reservations, the relationship observed is an important source of hypotheses and is found to underly many different modes of approach. The portraits of parents that emerge from interviews with children and from TAT protocols differ in the expected direction according to whether or not the children are field dependent of field independent. Intensive examination of the social environment of field-dependent and field-independent subjects during their youth produces an environmental characterization that is completely compatible with the preceding results (see Witkin, 1969). The greater field dependence of the blind has been explained by the lack of autonomy in their relationship with their mother during childhood (Witkin et al., 1968).

Other studies have directly compared the field dependence of parents to that of their children, assuming that the environment created by parents according to their cognitive style will contribute to the production of an identical cognitive style among children. Since the measures were objective, there was no risk of calculating spurious correlations as there was when judgments were based on interviews. The problems of causal imputation are, however, obviously identical. Witkin et al., (1962) reported positive correlations between maternal field dependence as evaluated by drawing and the EFT, and field dependence on the part of their respective children, with similar findings being reported when other indices of the children's differentiation were used. These findings were significant, however, only in the case of drawing. In a recent study, Goldstein and Peck (1973) calculated the correlations between the RFT scores of mothers and their children for 181 subjects from 8 to 15 years of age belonging to several ethnic groups. The correlations were .29 for boys and .26 for girls. Unfortunately, the subjects were emotionally disturbed children, a fact which constrains the possibilities of generalization. Corah's correlations (1965), cited previously, also emphasize the positive correlations between the field dependence of child and parents. The interpretation of these correlations is not easy, and the hypothesis of a simple "imprinting" by the environment is notoriously insufficient because of irregularities in the patterns of intrafamily correlations. Goldstein and Peck's correlations vary strongly as a function of ethnic group and father presence. There have been attempts to account for these dissymetries through reference to the process of parental identification, but such a relationship does not necessarily have the same significance relative to field dependence in girls as boys. Bieri

(1960) has measured identification by the proximity of children's and parents' responses on Osgood's scales. He showed that, for a group of university students, the relationship between identification with the father rather than with the mother and with field independence was valid among girls while the relationship between submission to authority and field dependence was observed for the most part among boys. Among the latter, subjects who were not submissive to authority and who identified with their mothers were more field independent than subjects who likewise resisted submitting to authority but who identified with their fathers. These results can help to explain a part of the pattern or correlations within families found by Corah. The fact that this pattern is not found among Blacks, where the correlation between mother and daughter is clearly superior to that between mother and son (.42 and .28) poses another problem. In our opinion, it does not necessarily call the genetic hypothesis into question even though it would necessitate hypothesizing a transmission mechanism specific to the Black population--which does seem highly unlikely--but merely is evidence for the existence of only strong interactions.

Some research has been carried out on the role of the father in the process of differentiation. Barclay and Cusumano (1967) have stated that performance on the RFT is lower among boys when the father is absent from the home--paternal absence, for these authors, being the cause of sexual role conflicts which have surfaced as a lesser degree of differentiation. This interpretation is, of course, not the only one possible. Goldstein et al. (1973), have calculated mother-child correlations for RFT scores while controlling for paternal absence as measured by length of time since departure in reference to the age of the child. Their results were somewhat surprising. The mother-child relationship is strong in direct positive relationship to the father's presence. It could be surmised, for example, that a consequence of the father's presence was greater frequency of mother-child contacts, or even that this presence led to an increased role specialization on the part of the mother and thus to greater influence by her cognitive style.

Sexual differences.

Adolescent boys and men are, on the average, more field independent than are adolescent girls and women. This finding has held true for very diverse groups regardless of the indicator of field articulation used. Among children, the results are contradictory and it is not until about 10 years of age that the difference between the sexes becomes noticeable. This difference disappears among the aged. After pre-training on the RFT or the EFT, masculine subjects still out-perform female subjects, but the difference is reduced (Olson et al., 1965; Goldstein & Chance, 1965). Witkin (1950) reported that for adults the mean time necessary for the resolution of the 24 problems of the EFT was 15 minutes 54 seconds for men (SD = 12 mn 48 s) and 23 minutes 18 seconds for women (SD = 15 mn 12 s). These differences are much weaker than it would appear since an examination of the distribution shows that over 40% of the women attained and surpassed the average male performance. Such overlapping would explain the possibility of nullification and even reversal of sex differences in other studies where there may have been a sampling bias. The results also

demonstrate that it is both unfounded and dangerous to speak of a masculine or feminine perceptual style--notions which reflect social stereotypes. What is one to think, for example of designations such as Logos for the masculine prototype and Eros for the feminine (in J. Silverman, 1970)? In our opinion, the interest of the study of intersexual differences lies principally in the extent to which it can contribute to a specification of the origin of inter-individual differences.

If field independence is controlled by a recessive gene carried by the X chromosome, then, on the average, females will have lower scores than males since the probability of inheriting the genetic make-up that would permit field independence would be less. Two very different types of physiological mediators have been proposed, one positing the intervention of sex hormones and the other the functional asymmetry of the cerebral hemispheres. Broverman et al. (1968), were not particularly interested in field dependence as such, but rather in the dichotomy of cognitive activities in which it figures. It will be recalled that these authors were distinguishing tasks requiring simple perceptual-motor associations in which girls would be superior to boys and tasks based on the processes of inhibition and restructuration where it would be the boys who would have superior scores. Culturally based hypotheses being rejected on the basis of an examination of inter-sexual differences among animals, the authors present a model based on the opposition of adrenergic and cholinergic systems. Sex hormones, through their effect on this equilibrium, would be responsible for performance differences between the sexes. The estrogenic hormones would suppress the production of cholinesterase and facilitate (more than would androgenic hormones) the production of substances intensifying the adrenergic activity. Thus, there would be a relative superiority for girls on perceptual-motor tasks and for boys on tasks of spatial restructuration. Let us note in passing that the disequilibrium between the two systems implies nothing as to the intensity of their activity and that this model is in perfect agreement with the ipsative conception of styles defended by Broverman. Doubts have been voiced about the validity of the dichotomy of tasks proposed, and the lack of work on the specific effects of the injection of hormones among girls and boys has been regretted (Maccoby & Jacklin, 1972). The other type of mediation proposed concerns the degree of specialization and dominance of the cerebral hemispheres. A critical analysis of the hypotheses and work of Kimur, Lévy and Sperry on this subject can be found in Maccoby and Jacklin (1972). Hemispheric specialization--right hemisphere dominance for spatial abilities and left hemisphere dominance for verbal abilities-- is established during the course of development. This would be more precocious among girls as concerns the left hemisphere and would thus lead to a relative inhibition of the development of the functions controlled by the right hemisphere. A hypothesis, incompatible with this, has also been advanced: that it is the lesser degree of lateralization of girls that would be responsible for their inferiority in the spatial domain. These hypotheses do not, however, take into account the late appearances of these differences, nor do they explain why differences between boys and girls can be in the opposite direction for abilities controlled by the same hemisphere (visualization and motor dexterity, for example). Obviously, these considerations remain very speculative.

In the preceding hypotheses, there has been no distinction made between spatial ability and field-dependence. Sherman (1967) has attempted to demonstrate that the differences between girls and boys in tests of field dependence can be reduced to differences in visualization. These differences would be explained by the differential learning experiences undergone by girls and boys. This proposal is difficult to accept since, although there is a relationship between spatial visualization and field dependence/independence, especially when the latter is evaluated by the EFT, we have seen that it is not enough to justify the assimilation of the two dimensions, which, moreover, do not have the same status. If it is true that boys and girls handle different objects, notably toys, it is still not clear, as Maccoby (1966) points out, that this can influence spatial visualization. Moreover, and frankly incompatible with Sherman's hypothesis, boys who are closer to the masculine stereotype are not those who have the most elevated ipsative scores of spatial ability. Instead, the situation is reversed (Fergusson & Maccoby, 1966).

As in studies of inter-individual variability, two large classes of hypotheses have been proposed to specify the action of the environment on differences between the sexes. The first looks to socialization practices from early infancy on, and the second relies upon processes of identification. Parental socialization behavior that tends to maintain a weak degree of differentiation among young children would be more frequent in relation to girls than to boys. Witkin (1969) has emphasized the hypothetical nature of this proposition--his group's work having been done only upon relationship between mothers and sons. An investigation completed by Maccoby on infants from 0 to 6 years did not uncover evidence for differential treatment of girls and boys in training for autonomy (Maccoby & Jacklin, 1972). Within the framework of such a hypothesis, moreover, differences between the sexes, which is a central element in all this discussion, suggests an influence of the socialization factors operating at the onset of adolescence factors of socialization which remain to be defined.

Identification with the masculine role as measured by scores on masculinity-femininity scales, correlated positively with field independence (Witkin et al., 1962). Fiebert (1967) has shown that this relationship is especially marked among girls for those items relating to attitudes and emotions. The complex web of interactions relating the interiorization of sexual roles and field dependence has been illustrated by Vaught's research (1965). A relationship between field independence and masculinity (as evaluated by Gough's scale) was found, and there was also evidence of a positive relationship between field independence and ego strength. Ego strength characterized the adaptability of the subjects and was measured by 68 items from the MMPI permitting the prediction of improvement among the mentally ill after a short hospitalization. It has also, and very interestingly, been observed that ego strength reinforces the tendency to respond in a manner congruent to one's own role, that is, for girls to be field dependent and for boys to be field independent (Fig. 4).

Masculine roles would generate field independence to the extent that they inculcated social attitudes reinforcing that independence, for example,

a preferential orientation toward things rather than people. It has also been proposed that the feminine role could lead to greater field dependence since it is less well-defined. This proposition remains to be proven. It would be useful, among other things, to specify the relationship between sex roles and parental identification and their possible influence upon field dependence/independence. An attempt in this direction has been made by Lynn (1969). No matter what hypotheses have been retained, in all cases, an attempt has been made to account for differences through factors acting upon the personality as a whole--and thus upon perceptual differentiation. This agrees quite well with Witkin's general framework, but still leaves untouched a fundamental question of personality theory: That of the nature of the relationship between cognitive and socio-emotional aspects of personality.

Cross-Cultural Studies

Numerous cross-cultural studies have been done, a resume of which can be found in Witkin (1967) and Witkin et al., (1973b). The most frequent finding is the general applicability of the notion of cognitive style, with perceptual and personality characteristics being associated among groups differing widely in type of economic activity, level of development or modalities of social organization. However a certain number of the problems already referred to arise within the specific context of some groups. It will be recalled, for example, that the correlations between the RFT and the EFT are particularly low among traditional African groups. The large diversity evidenced in child-rearing practices of different ethnic groups has permitted, to some extent, the testing of hypotheses relative to the role of environment in the development of individual differences.

Dawson (1967) compared two tribes in Sierra Leone: the Temne and the Mende. Among the Temne, child-rearing practices emphasize group conformity and discipline; there is frequent use of corporal punishment and, due to polygamy, women are mostly responsible for socialization of children. Among the Mende, on the other hand, discipline is much less strict and independence is encouraged, and they score higher than the Temne on the EFT and on Kohs' cubes which is compatible with Witkin's hypotheses. Berry (1966) has compared the Temne to a group different from the Mende; the Eskimo of Canada who exercise very little control over their children, show them much affection, punish them rarely and encourage them to take responsibility. The Eskimo are clearly more field independent than the Temne, their performances being equivalent to that of Scottish subjects having about ten years of schooling. Here, again, child-rearing practices and cognitive styles are found to be associated. Westernization, intensified by urbanization and the development of educational institutions, leads to a greater degree of field independence in both cultures.

But, as is demonstrated by the large difference between the Eskimo and the Temne, it is necessary to exercise caution in imputing causality. Differences in the physical environment are massive as are those concerning economic activity, the Eskimos being hunters and the Temne farmers.

The social environment is also different: among the Eskimos graphic and pictorial production predominates and their language is much richer than that of the Temne in terms describing the geometrical properties of space. Of course, these characteristics could be the consequence of greater differentiation, but they also no doubt contribute to its creation. Psychological characteristics are also related to field independence among Eskimos and can reinforce it, especially in regard to high discriminatory and visual-perceptual abilities. We are faced, literally, with a tangled web of variables, and the situation becomes even more complicated when one considers the genetic factors which cannot be a priori eliminated. There are even good reasons to think that field independence is an advantage in the context of Eskimo life and that it could have played a role in the genetic evolution of this population.

Comparative work completed on groups less culturally distant than the Temne and the Eskimo have led to identical results. Dershowitz (1971), working in the United States, compared boys from orthodox Jewish families to boys from Protestant families finding that the former were less differentiated. Within their familial environment the mother is dominant; she does not seek to facilitate the development of autonomy and religious practices occupy a central place in daily life. Witkin et al., (1973b) chose two villages in Holland, Italy and Mexico that differed in regard to intensity of conformity demanded by familial, religious and political donventions. In Italy, for example, this social pressure is less in northern villages than in southern ones. Samples of children were observed in each village and evaluated through use of the RFT, EFT, WISC cubes and the figure-drawing test. It was systematically verified that for the three paired villages, regardless of indicators used, subjects were more field dependent when pressure toward conformity was greater. The inter-village difference was quite large (see, for example, Table VIII).

The interactions observed demonstrated that there were other factors at work. There was, for example, the "village effect" which was more evident among Italian young people or among girls in Mexico. The results obtained in the course of cross-cultural studies are consistent and strongly suggest that there is an influence of child-rearing methods relative to socialization upon field dependence/independence. This type of study, however, hardly permits a fine analysis of the effect of parental behavior.

Differences between the sexes has consistently been found in the various ethnic groups with one notable exception--they are insignificant among the Eskimo (Berry, 1966; McArthur, 1967) where in spite of a marked division of work along sex lines, females are not socially dependent on males. This is compatible with the thesis of an explanation of inter-sexual differences due to social roles. It is unfortunate that we do not have available systematic measures of field dependence for those rare groups where a weak specialization or a reversal of traditional sex roles is observed. It would be, for example, interesting to know if, as could be hypothesized, the differences between the sexes would be nullified among the Arapesh and the Mundugumor studied by M. Mead or reversed among the Chambuli.

## Conclusion

Under Witkin's influence, numerous correspondences between individual differences in the perceptual domain and individual differences observable in contiguous personality sectors, such as that of cognitive function, or in seemingly unrelated ones such as social behavior or defense mechanisms, have been established. Personality can thus be understood as a concept whose unity is found, not in its particular characteristics but rather through a more general and productive principle--degree of differentiation. Field dependence/independence is only the manifestation of this general principle in the field of cognitive activities. The cognitive aspects are privileged since they are more susceptibel to an objective approach to personality, but this does not imply a subordination of socio-affective behavior to cognitive characteristics. We have seen that the operationally-defined outlines of the dimension are not totally without ambiguity, which is, moreover, the case with most psychological dimensions. As a hypothetical concept, field dependence can only be measured through a matrix of variables simultaneously employed, but it often happens that the dimension is defined by the use of indicators considered in isolation and then combined or even, due to reasons of economy, by the use of one indicator alone. If the problem studied has not been subjected to preliminary exploration, the risk is one of not knowing exactly what is being measured--an obvious source of obscurity in a certain number of results. But, over and above these technical considerations, other results call for theoretical development, and even the concept of style itself in many of the studies examined needs to be extended, in our opinion, in more multidimensional directions. It appears paradoxical to define a style with the aid of a single dimension which is as minimally specific as greater-or-lesser-degree-of-differentiation. Style in that case has a quantitative aspect which is not necessarily valid when defined by a pattern of positions plotted on several dimensions. Unidimensionality can lead to identifying the concept of style with that of aptitude (field dependence/independence becoming then but one of the components of intelligence) or with that of level of development. In both cases the quality of individual differences is lost from view. We have noted that the operational translations of Werner's theoretical dimension "fixity-mobility" if associated with field dependence/independence could increase the coherence of individual differences. This dimension also presents the advantage of emphasizing variables relative to the situation since mobility can be defined as a function of the characteristics of the situation. Finally, Witkin, by thoroughly exploiting a central aspect of the theory of development--differentiation--in its various guises, has brought to light a fundamental aspect of personality. It remains, to explore, if possible with the same breadth and the same rigor, the complementary principle--hierarchical integration.[4]

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[4]Since this article was published, several reviews have appeared or are in press. They deal with, among other topics, learning and memory (Goodenough, 1976), social behavior (Witkin, Goodenough, 1976), educational implications of cognitive style (Witkin et al., 1976) and cross-cultural studies (Witkin, Berry, 1975). Also, the bibliography indicated (Witkin et al., 1973a) has been enlarged by the addition of two supplements.

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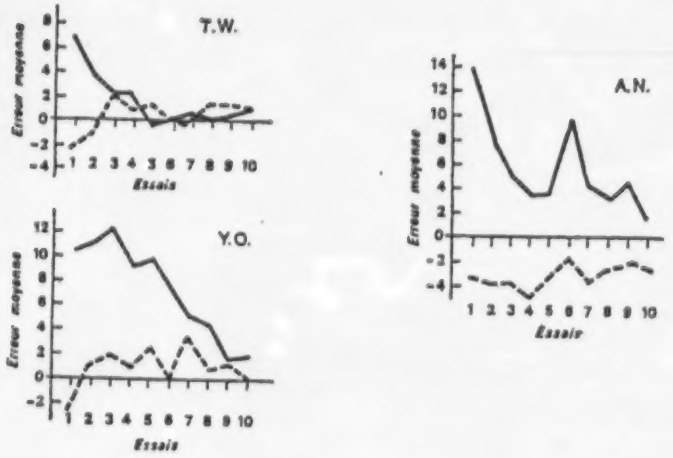


Figure 1. Individual learning curves on the RFT for 3 subjects

erreur moyenne - mean error
essais - attempts

Each attempt is made up of two series of 8 measures. The mean error for each series is represented for each attempt. In one series (continuous line), head and frame are tilted to the right, in the other (broken line) the head is tilted to the right and the frame to the left. The mean error, measured in degrees, is negative when the subject places the rod to the left of true vertical. In one series, the Aubert effect and the field effect are in the same direction; in the other, they are in opposite directions, whence the dissymmetry of the curves. All attempts took place in the same day, at 45 minute intervals. (Kato, 1965a).

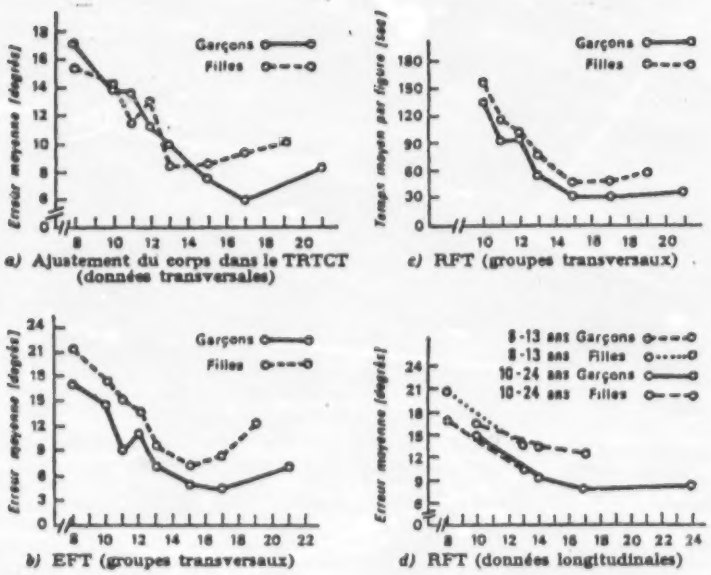


Figure 2. Developmental curves for principal indicators of field dependence (ages on the abscissa) (Witkin et al., 1967)

garçons - boys
filles - girls
ans - years old
erreur moyenne (degrés) - mean error (degrees)
temps moyen par figure (sec) - mean time per figure (seconds)

a) Adjustment of body in TRTCT (cross-sectional data)
b) EFT (cross-sectional groups)
c) RFT (cross-sectional groups)
d) RFT (longitudinal data)

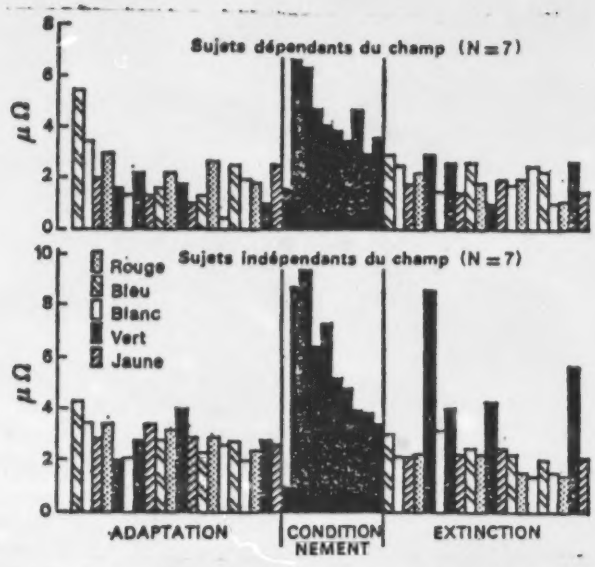


Figure 3. Mean amplitudes, in microhms, of initial electrodermal responses to the presentation of collored stimulus (the first response which appears in a delay of between 1.5 and 5 s after stimulus presentation) for adaptation periods (20 attempts), conditioning (10 attempts) and extinction (20 attempts) (Hein et al., 1965).

sujets dependants du champ - field-dependent subjects
sujets independants du champ - field-independent subjects
conditionement - conditioning
rouge - red
bleu - blue
blanc - white
vert - green
jaune - yellow

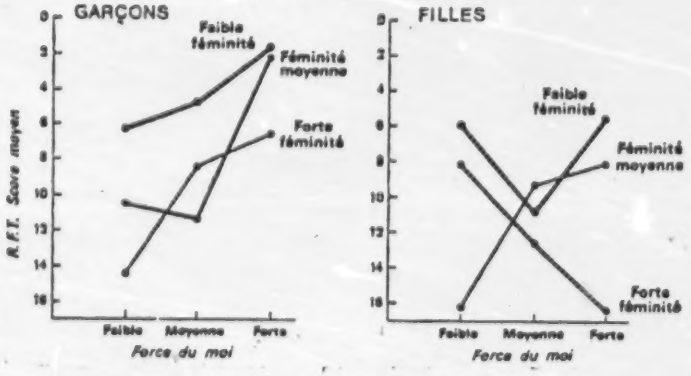


Figure 4. Male or female role identification, ego strength and performance on the RFT among girls and boys. There are 10 subjects in each of 18 groups (Vaught, 1965).

garçons - boys
filles - girls
R.F.T. score moyen - RFT mean score
faible - weak
moyenne- moderate
forte - strong
féminité - feminity
force du moi - ego strength

TABLE I

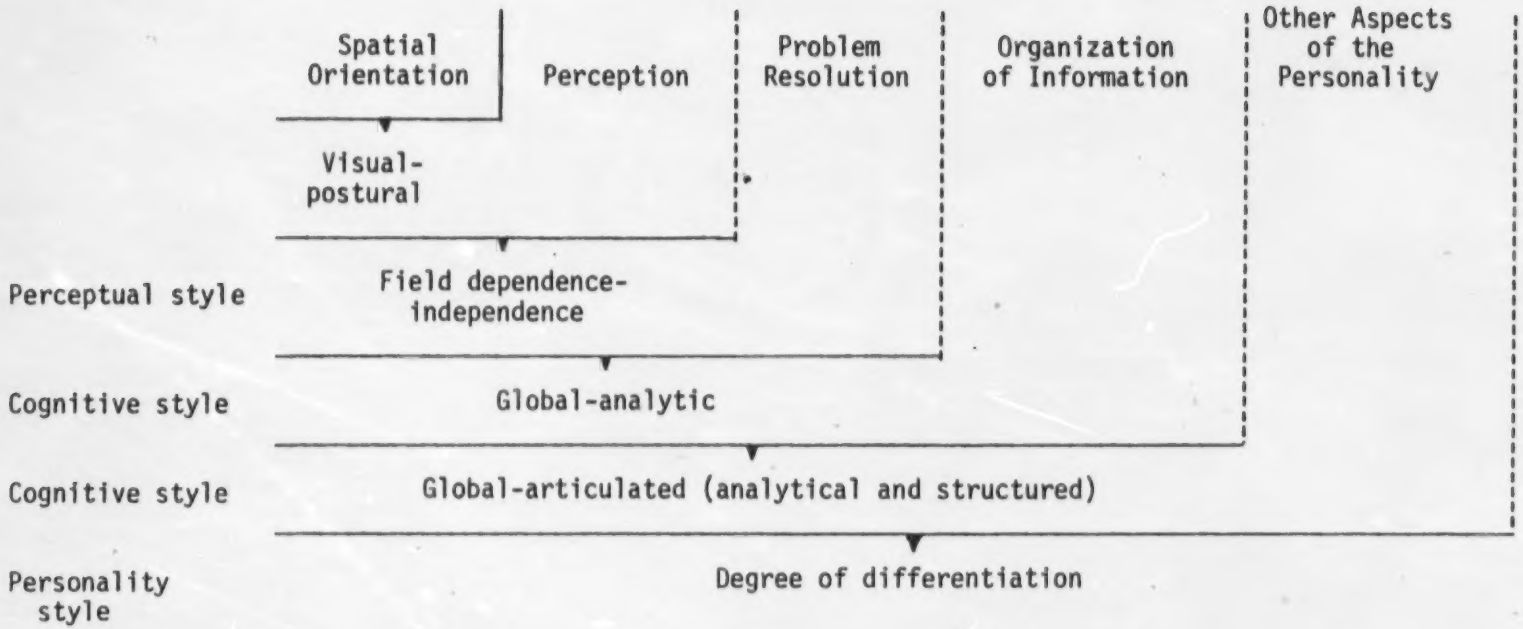
Spatial Orientation
Perception
Problem Resolution
Organization of Information
Other Aspects of the Personality
Visual-postural
Perceptual style
Field dependence-independence
Cognitive style
Global-analytic
Cognitive style
Global-articulated (analytical and structured)
Personality style
Degree of differentiation

TABLE II

| | BAT | RAT | RFT | EFT |
|---|---|---|---|---|
| BAT. . . . . | | .28** | .43** | .54** |
| RAT. . . . . | .31 | | .37** | .56** |
| RFT. . . . . | .39** | .44** | | .64** |
| EFT. . . . . | .58** | .25 | .21 | |

Correlations obtained for college students (males above the diagonal; females below) for the variable in effect but always greater than .51.

BAT: Adjustment of body to vertical in the TRTCT.

RAT: Adjustment of room to vertical in the TRTCT.

Correlations marked** are significant at .01 (after Witkin et al., 1962). (The adjustment of the room to vertical, on the basis of considerations relative to the intercorrelations and to the analysis of the task, is no longer considered an indicator of field dependence.)

TABLE III

| | a | b | c |
|---|---|---|---|
| a . . . . . | | .59 | .53 |
| b . . . . . | .47 | | .52 |
| c . . . . . | .56 | .48 | |

Correlations between three series of the RFT: a: subject tilted in the direction of the frame. b: subject tilted in direction opposite to that of the frame. c: subject not tilted. Girls are below the diagonal, boys above (after Witkin et al., 1954).

TABLE IV

| | Sex | 13 years old r | 13 years old N | 14 years old r | 14 years old N | 17 years old r | 17 years old N | 24 years old r | 24 years old N |
|---|---|---|---|---|---|---|---|---|---|
| 8 years old | M | .76 | 26 | | | | | | |
| | F | .48 | 21 | | | | | | |
| 10 years old | M | | | .71 | 27 | .72 | 27 | .66 | 27 |
| | F | | | .81 | 24 | .62 | 24 | | |
| 14 years old | M | | | | | .92 | 27 | .84 | 27 |
| | F | | | | | .76 | 24 | | |
| 17 years old | M | | | | | | | .90 | 27 |
| | F | | | | | | | | |

Stability coefficients for the RFT (all coefficients are significant at .01 with the exception of .48 which is significant at .05.) (Witkin et al., 1967).

TABLE V

| | I | II | III |
|---|---|---|---|
| BAT ..... | 09 | 09 | 43 |
| RFT ..... | -05 | 03 | 69 |
| EFT ..... | -03 | 09 | 69 |
| Information ..... | 67 | 10 | 07 |
| Comprehension ..... | 46 | 01 | -32 |
| Arithmetic ..... | 53 | 46 | 06 |
| Similarities ..... | 57 | 05 | 06 |
| Vocabulary ..... | 73 | -08 | -08 |
| Digit Span ..... | 25 | 53 | -06 |
| Picture completion ..... | -07 | 07 | 52 |
| Picture arrangement ..... | -01 | -10 | 11 |
| Cubes ..... | 09 | 42 | 50 |
| Assembly of objects ..... | 06 | 09 | 33 |
| Code ..... | -06 | 43 | -10 |
| Mazes ..... | -06 | 10 | -10 |

Saturation of field-dependence tests in WISC factors (I: verbal comprehension; II: attention-concentration; III: analytic approach to the field). Presentation has been simplified by omission of additional factors and other variables. N = 30 boys, 9-10 years of age (after Goodenough and Karp, 1961).

TABLE VI

Correlations between intelligence, creativity and reversibility factors

| | Inversion | Reciprocity |
|---|---|---|
| Intelligence. . . . . | .28 | .68 |
| Creativity. . . . . | .52 | .22 |
| Hidden Figures. . . . . | .10 | .79 |

TABLE VII

| Age | (1) | (2) | | | (3) |
|---|---|---|---|---|---|
| | | 14 years old | 17 years old | 24 years old | |
| 10 years old | .64** | .34 | .73* | .49 | -.57* |
| 14 years old | .73** | | .45* | .54* | -.34 |
| 17 years old | .86** | | | .68* | -.42* |
| 24 years old | .95** | | | | -.48** |

(1) Inter-rater reliability, (2) Test-retest stability, and (3) Correlations with RFT of intellectualization scores (Schimeck, 1968).
*significant at .05, ** significant at .01

TABLE VIII

Scores of mean error in degrees on the RFT for two Italian villages. N = 25 for each of the eight groups (Witkin et al., 1973).

| | 9 - 11 years old | | 13 - 15 years old | |
|---|---|---|---|---|
| | girls | boys | girls | boys |
| Weak attraction to conformism | 7,9 | 8,0 | 7,3 | 4,6 |
| Strong attraction to conformism | 19,0 | 18,5 | 11,1 | 9,0 |

TABLE IX

| | Group 1 | Group 2 |
|---|---|---|
| Verbal I.Q. | 71,1 | 67,1 |
| Performance I.Q. | 76,3 | 70,5 |
| Verbal Comprehension I.Q. (voc., inf., comp.) | 61,2 | 60,5 |
| Attention-concentration I.Q. | 71,3 | 63,4 |
| Analytic approach I.Q. | 80,8 | 73,4 |